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Proposed Rules of the International Commission for the Standardization of Electrical Machinery.

In pursuance of the resolution of the Chamber of Delegates of the International Electrical Congress at St. Louis in 1904, to the effect that an international commission from the technical societies of the world should take up the standardization of the nomenclature and ratings of electric machinery, it is proposed that a meeting of delegates from the various national electrical engineering societies shall be held in London on the 26th of June next. The rules proposed for discussion at the meeting have already been drafted and printed. These rules relate entirely to the organization of the commission and do not touch upon the electrotechnical subjects to be considered. The proposed rules are fourteen in number, and while evidently prepared with the hope and intention of facilitating business, they appear to be unnecessarily complex. The main object at present to be sought for is a meeting of delegates from the various national electrical engineering societies. If this can be brought about, it is highly probable that the delegates will proceed to business upon the simplest and most natural lines of action. Attempts to stereotype the action of the meeting in advance are likely to hamper the proceedings and defeat the unanimity of purpose and resolution that may be hoped for.

The Maximum Efficiency of a Storage Battery.

Since storage cells were first introduced, the demands upon their electrical capabilities have steadily increased. The early storage cells of Planté were electrolytically formed from plain parallel leaden sheets in the course of weeks and months of preliminary charging and discharging, before they were regarded as fit for duty. When on duty they were not allowed to discharge to the practical low-voltage limit in less than six hours, and the period of recharging was not less than 24 hours. It would have been regarded as highly insulting to a storage cell of that day, not to say injurious, to ask from it a full charge and discharge in one and the same day. At the present time, however, central station storage batteries are commonly charged in six hours, and discharged in two, Although it is admitted that the efficiency of such a battery would be greater if it had a more leisurely day's work, yet the necessities of central station distribution prohibit the eight-hour-day working rule for storage batteries, and require three-hour working days, two-hour working days and even one-hour working days.

In any moderate or leisurely cycle of charge and discharge, it is known that the quantity efficiency, or ampere-hour efficiency, of a storage cell is nearly 100 per cent, and that even under hand labor the ampere-hour efficiency does not fall greatly below 100 per cent. It is the watt-hour or energy efficiency which suffers under stress. Under laboratory conditions of most careful and light loading, the watt-hour efficiency can be brought up to nearly 100 per cent, while under heavy and severe loading in practical service this efficiency may fall to about 70 per cent. In some experiments described by Prof. B. F. Bailey on page

829, two storage cells, each of 160 ampere-hours capacity, were allowed to charge and discharge 60 times per second, at 20 amperes effective current. That is, the normal eight-hour discharge rate was reduced to the 1/60th of a second, or 1/216,000th of an hour, a period 1,728,000 times shorter than the normal. The experiments showed a quantity efficiency of almost 100 per cent, and a watt-hour efficiency of 98.1 per cent under these conditions. The loss of charge in the cell subjected to this short but merry cyclic activity appears to have been less than when the cell was allowed to remain idle, on open circuit.

Covering High-Tension Line Wires.

There appears to be some ground for a profitable discussion of the question whether the so-called insulating covering of moderately high-tension lines in cities might not better be abolished. In the case of low-tension wires at voltages of 50 to 500, even a weather-proof insulation offers considerable protection against accidental short circuits, but by many it is held that there is also no question but that any practicable insulation that can be placed on overhead lines of 10,000 volts and up is worthless and a waste of money. There is left a large middle range of voltages in which the advisability of an insulating covering of overhead lines is open to question. At voltages of 1100-2200, which are so common, the ordinary insulating coverings may offer a slight protection. At voltages of 4000, 4600 and 6600 it is generally considered that a covering is more a matter of form than a really substantnal protection. The chief use for the covering in such cases seems to be to conform to the preconceived ideas of a non-technical public and the city authorities. Against the covering of such wires it is urged that it involves unnecessary cost, that the coverings deteriorate rapidly, that they cause a feeling of false security by linemen and others, and that in some cases the insulating covering would offer enough resistance to what would otherwise be a short-circuit to prevent circuit-breakers on a high-tension line from opening when it would be best that they should. It has been fairly well proven that the best protection telephone and telegraph wires have against high-tension lines lies in the fact that the falling of such wires across a high-tension line causes such a positive and immediate short circuit that the circuit-breakers in the latter immediately open before much damage is done to the telephone or telegraph system. The insulating covering on a moderately high-tension line may delay the opening of the circuit-breaker, although a dangerous current may be flowing. This whole subject is one which deserves thoughtful consideration.

The Full Utilization of Water Power.

We tell the story this week of a hydro-electric plant which is notable, not from magnitude, length or voltage of transmission line, or indeed any details of technical design, but from its bearing on the proper and complete utilization of natural energy. The greatest problem of hydraulics is the full employment of the power that nature has bestowed, bountifully, it is true, but without the least reference to the wishes and present welfare of mankind. The rivers flow without ceasing, while the amount of steady flow upon which mankind ordinarily depends bears no particular relation to the aggregate. The work upon the Raquette River which we here describe involves a particular solution of this problem by providing a load variable at will and able to take up in large measure both the variations of flow and of electrical demand. A pulp grinding plant and an electrical transmission plant are here operated in conjunction under the same roof. Pulp can be ground at any time when the power is available, and by storing the product the output can be made commercially uniform even though the original power is very variable. From the simple nature of the industry, the ample demand for the product, and the large proportion of the cost due to power, pulp grinding is especially well adapted for collateral work in a hydro-electric development in a forest country. With the help of some storage of water in the lakes up stream it should be possible to utilize a considerable proportion of the total annual energy.

This is very unusual in hydraulic plants of any kind, which are generally at the most intended to take care of the average flow, with the result that a third or a half of the total available power runs over the dam. The first great step toward the prevention of waste is the storage of water as such. When this can be carried out in full, as is now and then possible, a comparatively insignificant stream can be converted into a valuable and reliable source of power. In the larger streams the lake space required for storage of the full run-off over the drainage area becomes, for present conditions, prohibitively large. Some day, when fuel shall have become scarcer, great artificial lakes will become commoner. As things now are, there is a large amount of storage done for the purpose of covering the ordinary variations of flow, but very little with the view of saving the energy lost in the maxima. The power required in hydro-electric stations is a very variable quantity. The peak load is commonly more than twice the maximum, and at times of low load there is very often great waste of water, either from lack of suitable storage capacity or from inability to utilize storage on account of the demands of plants lower down on the stream. This condition of necessarily limited storage is a very common one, since a well-developed river is covered by successive plants, between some of which very inadequate storage facilities exist. The result is that perhaps half the hydraulic energy in one fall may have to be wasted to meet the needs of a really less valuable fall just below, but having a different distribution of load.

The value of an auxiliary load such as is secured in this Raquette River plant by the addition of pulp-grinding machinery is very obvious. The load on this auxiliary is fully controllable, so that at times of low electrical demand the full normal output of the fall can still be secured. At periods of unusually great flow the pulp load can be carried day and night up to the capacity of the plant. The same principle can be carried out with other industries where wood for grinding is not easily available. Of course, only a small proportion of hydraulic privileges are so favorably situated as that on the Raquette, but in general cheap energy being necessary to the pulp industry, wood will have to be carried to the plant, and whenever the hydraulic conditions are favorable there is advantage in working the electric plant and the pulp mill together. By so doing very cheap energy can often be obtained, and both branches of the industry can be made to pay handsomely. There are divers electrochemical industries—alumina reduction for example, which can be worked on a larger scale in similar fashion—in fact any energy consuming industry

that can be varied in output of product within reasonable limits, can be thus made auxiliary to general power distribution. The electrochemical industries in the measure that they are conveniently more continuous than pulp grinding, can be less freely varied in output, but with proper tact in management a very steady total load could be obtained. There is every reason for a general investigation of such opportunities, for they give an admirable chance for largely increasing the ultimate profits for a given investment. And the auxiliary industry need not be under the same roof with the power plant, as in the example here discussed, but may be anywhere within easy radius of transmission. In other words, an electric transmission project may profitably be combined with an energy using industry of such nature that it can fully utilize a variable power.

Graphic Representation of Induction Motor Phenomena.

The variations in the several methods which have been used by different writers when discussing the phenomena connected with the operation of an induction motor can be attributed to the simultaneous similarity of the machine to a stationary transformer and to a shunt-wound, direct-current motor. Electrically considered, the induction motor is the equivalent of a stationary transformer possessing a core of high reluctance and coils of large reactance, and all of its electrical characteristics can be studied by treating the input side of the machine solely as a transformer. The mechanical equivalent of the machine is found in the direct-current shunt motor, and its output and mechanical performance may easily be investigated when this fact is kept in mind. It is possible to consider the secondary winding of the induction motor as a circuit of constant resistance and constant self-induction and subjected to a variable e.m.f. at a variable frequency. It is possible also to consider that the secondary winding is subjected to a constant voltage, a portion of which is used up in the winding itself and the remainder of which, the counter electromotive force of rotation, is useful in producing mechanical work. Owing to the fact that the current which flows in the secondary winding at the frequency corresponding to the slip produces a secondary magnetic field which revolves at the slip frequency and in a direction opposite to the slip, the secondary field reacts upon the primary field with the primary frequency. It is possible, therefore, to treat both the primary and secondary circuits as though they belonged to a stationary transformer operated at constant frequency.

In view of the facts stated above, it would seem that the simplest method for dealing with induction motor phenomena is one treating the machine as a stationary transformer, its output characteristics being determined from the input performance of the motor modified by the internal behavior of the machine. An advantage possessed by the graphic over the algebraic method of treating the induction motor as a transformer is found in the fact that by the use of the former method one is able to follow the changes in the variables connected with the phenomena during operation and can thus determine at once the dependance one upon the other of the numerous characteristics, and thereby can predict the effect of altering any constant of construction, while with the latter method these changes and their effects are more or less hidden. The possibility of obtaining from algebraic equations that clear conception of the performance of the induction motor which is readily acquired from the use of the graphic diagrams is seriously to be doubted. It is believed that the graphic method which involves the use of the circle diagram possesses peculiar merit with reference to simplicity in application and practical accuracy in results. On page 825 of this issue there is given a brief discussion of the facts upon which the construction of the simple circle diagram depends, and mention is made of the uses to which the diagram may be put. The article serves to emphasize the fact that the true primary current locus is not a circle, but that the secondary current follows a true circular locus.

Just as there are numerous methods for representing the performance of an induction motor, so are there many methods for explaining the shape assumed by the locus showing the value and phase position of the primary current. Perhaps the simplest method is the one based on the assumption that the wattless and the power components of the no-load primary current remain constant, and that the actual primary current is the resultant of these two components and a third component equal and opposite in magnetomotive force to the secondary current, which latter components can be represented by a circular locus. Another simple explanation is based on the assumption that the actual flux in the primary core is constant, and that the primary leakage lines and secondary leakage lines are proportional to the respective currents. It is evident that the assumptions made in each of these methods are not strictly in accord with the facts, since both the core flux and the magnetizing ampere-turns to produce this flux decrease with the drop in pressure through the primary coil. It is worthy of note, however, that even with the simplest possible diagram the results are sufficiently exact for all practical purposes. The whole problem resolves itself into one of choosing the simple circular current locus with its well-known and easily-corrected inaccuracies, or selecting the more complicated modifications with inter-involved approximations to the true results.

In the actual test of an induction motor observations made of the primary quantities with the rotor stationary serve to place accurately one point on the true primary current locus, while the no-load synchronous readings allow another point to be found on the true locus. If a circle is drawn through these two points with its center approximately near the mean center of the true current locus, it cannot fail to pass so near the true locus that the components of the primary current and the corresponding secondary current for each point on this curve will give results in the final computations very closely the same as found in a complete commercial test of the machine. The circular current locus is frequently referred to as the "Heyland diagram." It is not correct, however, to assign to any one man the exclusive credit for having developed this most simple and complete method of treating induction motor phenomena, because numerous workers have independently developed practically the same method, and strangely enough almost simultaneously. It should be mentioned, however, that Mr. B. A. Behrend in a series of articles which appeared in the Electrical World and Engineer during the year 1900 was the first writer to point out the advantages of the diagram to American readers, and that his first publications in Germany were contemporaneous with those of Mr. Heyland. It is noteworthy also that as early as the year 1893 Dr. F. Bedell and Dr. A. C. Crehore, in a series of articles which appeared in the Electrical World, showed that the current locus of a constant-potential stationary transformer is the arc of a circle.

Annual A. I. E. E. Convention.

The following programme has been prepared for the twenty-third annual convention of the American Institute of Electrical Engineers, to be held at Milwaukee, May 28 to June 1:

"The Repulsion Induction Motor," by Mr. Maurice Milch; "Direct-Current Motor Design as Influenced by the Interpole," by Mr. Charles H. Bedell; "Experiences with Lightning and Static Strains on 33,000-volt Transmission Systems," by Mr. Farley Osgood; "Cell Type Lightning Arrester," by Prof. E. E. F. Creighton; "Protective Apparatus for Lightning and Static Strains," by Mr. H. C. Wirt; "Short-Circuit and Ground Currents in Alternating-Current Systems," by Dr. C. P. Steinmetz; "Magnetic Properties of Electrolytic Iron," by Prof. C. F. Burgess; "Measurement of Temperature by Electrical Means," by Mr. Edwin F. Northrup; "The Educational Value of an Electric Test Car," by Prof. T. F. Morgan; "The Art of Inventing," by Edwin J. Prindle, Esq.; "Shunt and Compound-Wound Converters," by Mr. W. L. Waters; "Economics Derivable from the Use of Relatively Small Water Powers of Low Head in the Middle West," by Prof. D. C. Jackson; "Oscillations and Surges Against Ground in Alternating-Current Systems," by Dr. C. P. Steinmetz; "Relative Merits of Various Types of Booster Control," by Mr. Joseph Bijur; "Safety Devices for Steam Engines, Turbines and Motors," by Mr. Charles M. Heminway.

Franklin Bicentenary Exercises at Philadelphia.

One of the most notable gatherings which we have ever had occasion to record was that which has been doing honor to the memory of Benjamin Franklin during the present week at Philadelphia. The occasion is the bicentenary exercises of the American Philosophical Society in celebration of the birth of Franklin, its founder and first president. Elaborate receptions were planned by the Society for delegates from the great institutions of learning of the world, and from the national legislature.

The city presented a holiday appearance, the various public and private buildings being decorated with the colors of the city, blue and gold, United States flags and flags of all nations. The City Hall was outlined with streamers of incandescent electric lamps, crowned with a wreath of brilliant arc lamps, and surrounded by brilliant rows of red, white and blue lamps. On each side of the building immediately over the four main archways was placed a huge kite whose prominent features were studded with incandescent lamps. The tail of the kite was formed by a row of lamps while a similar row served for the string, at the end of which was attached a key outlined with incandescents. The statue of Franklin at the *Public Ledger* building was decorated with streamers of incandescent lamps, to which was attached an illuminated kite, a key built up of electric lamps being suspended from Franklin's hand. Busts of Franklin formed the central figures in the interior decorations of the buildings used for the meetings.

The official opening of the celebration was on Tuesday evening, when the delegates, invited guests and members of the Society assembled at Witherspoon Hall to listen to the address of the president of the American Philosophical Society, vice-provost Edgar F. Smith, of the University of Pennsylvania. The address by Dr. Smith was primarily one of welcome to the delegates, but it dealt to a large extent with the many-sided career of Franklin, the first president of the Society. After outlining the numerous electrical experiments performed by Franklin, Dr. Smith stated that he had given certain explanations of electrical phenomena which have been modified only slightly during the past 200 years, and that Franklin was the first investigator to understand static electricity. He appreciated the oscillatory nature of the spark discharge, and he had entered upon some work of the nature of that subsequently brought to completion by Hertz. Dr. Smith mentioned also the fact that Joseph Henry had been a member of the Society. The second president of the Society was David Rittenhouse, whose theory of the magnetism of iron propounded in 1781 continues to be viewed by scientists as representing the facts. Among other members of the Society who became distinguished through their work with electricity may be noted Robert Hare, who gave an account of galvanic apparatus in 1821, and John W. Draper and Samuel F. B. Morse, who developed the electromagnetic telegraph.

At the conclusion of the presidential address, the names of the delegates were called in the order of the foundation of the various learned societies or institutions of learning which they represented, beginning with the University of Oxford (twelfth century) and ending with the Sociedad Aragonesa de Ciencias Naturales, which has recently been formed. There were 126 institutions represented on the list, and it is estimated that there were 200 delegates present. With only few exceptions, each institution represented had sent a formal address printed on parchment and bearing the official signatures. The addresses from those institutions founded before the year 1800 were read in full, but the other addresses were presented without being read.

The event of the evening on which the major portion of the interest seemed to have been centered, was the conferring on Miss Agnes Irwin, dean of Radcliff College, who is a great-granddaughter of Franklin, of the honorary degree of Doctor of Laws by Mr. Andrew Carnegie as Lord Rector of the University of St. Andrews. Mr. Carnegie remarked that, although St. Andrews had in 1759 bestowed upon Franklin the degree of LL.D., Franklin was at that time a British subject, and that the present recipient was the first American to whom such an honor had thus been given, and that the present Lord Rector is the first American to occupy such a position connected with the university during its 500 years of existence. At the conclusion of the official exercises of the University of St. Andrews the delegates were given an informal reception by the members of the American Philosophical Society.

The exercises extended from Tuesday until Friday, an outline of the programme for the last three days being as follows: Practically the whole of Wednesday was devoted to the presentation of papers on subjects of science. Of the 16 papers three dealt directly with electricity: "On Positive and Negative Retrons," by Prof. H. A. Lorenz, of Amsterdam; "Franklin's Researches in Electricity," by Prof. E. L. Nichols, of Ithaca; "The Modern Theories of Electricity and their Relation to the Franklinian Theory," by Prof. Ernest Rutherford, of Montreal. The programme for Thursday included the conferring of honorary degrees by the University of Pennsylvania and an oration by Hon. Hampton L. Carson, attorney-general of Pennsylvania, in the forenoon, and ceremonies at the grave of Franklin under the auspices of F. & A. M. of Pennsylvania in the afternoon, with a formal reception at the Bellevue-Stratford in the evening.

The programme for the forenoon of Friday included addresses in commemoration of Franklin as citizen and philanthropist by Horace H. Furness; as printer and philosopher, by President C. W. Eliot; as statesman and diplomatist, by the Hon. J. H. Choate. The programme included the presentation of the Franklin medal to the Republic of France by the Hon. Elihu Root, while the afternoon was occupied in the reading of papers on subjects of science. The closing exercise was a dinner served at the Bellevue-Stratford.

In the printed list of delegates to the celebration, issued by the Society, almost 60 foreign scientific bodies and universities are represented, and somewhat more than that number of similar American bodies. The name of the American Institute of Electrical Engineers is singularly absent from the list, and owing it is understood to the indisposition of Dr. Wheeler it was not represented at the formalities on Tuesday evening. Among the more notable foreign bodies on the list are the Royal Society, Academie des Sciences de Paris, Universities of Oxford, Pavia, Cambridge, St. Andrews, Glasgow and Edinburgh; Academies of Science of Padua, Rome, Caen, Prussia, Gottingen, Barcelona and Rotterdam; Philosophical Societies of Manchester and Glasgow; Royal Institution, British Association for the Advancement of Sciences.

Among engineering bodies represented are the British Institution of Electrical Engineers, Société Internationale des Electriciens, Physical Society of London, British Institution of Mechanical Engineers, Institution of Engineers and Shipbuilders, North of England Institute of Mining and Mechanical Engineers and West of Scotland Iron and Steel Institute.

The Magnetic Club and Franklin.

The Magnetic Club held its spring dinner at the Hotel Astor, New York City, on Tuesday, April 17, this being the day selected for the joint celebration of the two great Franklin anniversaries —January 17, the day of his birth in 1706, and April 17, the day of his death in 1790. The dinner was as usual with these functions a delightful affair and was well attended by representative men and leaders in the telegraphic and other fields of electrical industry. Mr. A. B. Chandler, the president, was in the chair and acted also as toastmaster. Before the speaking began and while dinner was being served a long and excellent programme of vocal and instrumental music was executed. Mr. T. C. Martin as the first speaker of the evening congratulated the club upon associating itself with the great anniversaries that were now being celebrated in an adjoining city with the co-operation of the scientific and electrical bodies of the whole world. While Franklin was a universal genius, they were glad to claim him specifically as their own and as the first American electrician. As a man's rank in future time might often be judged from the merit accorded him among other nations in his life, it was significant that Franklin in his own day had been received and acclaimed as a philosopher, statesman and genius of the highest rank. Long before an ignorant English critic had inquired with a sneer, "Who ever reads an American book?" the collected papers of Franklin on electricity had been universally circulated and had even been done into Latin for the benefit of the ancients. In France, as our minister, as many as 150 separate portraits of him were printed, several medals were stamped in his honor and, as John Hay had said, his benevolent face, his fur cap and his spectacles were as familiar to the Frenchman as the head of the king on the louis d'or. Franklin had not only been an electrical philosopher, but a practical telegrapher, for he had discussed the sending of signals across the Schuylkill River and there was every reason to believe that he had done it, as it was his rule to put all suggestions to a practical test, like any later Faraday or Edison. None better than that audience could appreciate the tremendous growth of electricity since his day, when not a single man earned his living by the electrical arts; when not a single dollar was invested in electricity, and when the fundamental apparatus of the industry was so utterly unknown that Franklin himself coming into the banquet hall that night would not have recognized the electromagnet that was the badge of the club. Yet to-day the electrical bill of the American public annually was a billion dollars, so that every American was spending more for electricity than for daily bread, although not perhaps as much as he spent for whisky and cigars. Yet the present realization of that which Franklin had forecast would appear puny and insignificant a hundred years hence when the whole world had been electrified and every public function and service was performed through electrical means.

Mr. C. A. Coffin, president of the General Electric Company, was introduced as the head of the largest electrical manufacturing industry that the world had ever seen and was most enthusiastically received. He made a happy and impressive speech, expressing his pleasure at seeing the oldest electrical art so full of young men of vigor and ability, and congratulating the club also upon the fact that within its boundaries the officials of two great competing organizations in the telegraphic field were able to meet together on the basis of amity and in the closest and most harmonious relations. This was a consummation to be desired throughout the electrical field, where as each great electrical development shook itself free of its own internal and internecine warfare it was able to present a firmer front to outer, opposing forces and to make the swifter conquest of the great domains of public service awaiting attention and fruition. Mr. Coffin as one who had seen an active and strenuous life in the building up of electrical industries emphasized to his younger auditors the desirability of that patient and persistent labor that had been so marked in Franklin's own life, and without which nothing worth having or doing could be accomplished. He was glad to note that in the telegraphic field constant and steady advances were being made showing that the men in it were as acute, alert and industrious as ever; and incidentally he made a very interesting allusion to a recent experience in connection with wireless telegraphy. While in Egypt this winter he had had occasion from time to time to send cable messages to the United States. On returning home to this country a week or two ago he found that the cost of the wireless telegraph messages sent from the steamer off Nantucket, only a few hundred miles, was at least as great as for the cablegrams from the banks of the Nile. Whence he was led to infer that the days of wire telegraphy and of submarine cables were not immediately over, and that a good deal of work remained to be done in the cheapening and perfection of the latest wonderful art added to the resources of electricity.

Mr. A. R. Brewer, secretary of the Western Union Telegraph Company, made a brief address full of reminiscences of the earlier telegraphic days in which he had been associated with Mr. Chandler and General Eckert, and recalling the intimate association of those two men with Abraham Lincoln, Edwin M. Stanton and the other heroes of the Civil War. This characterization of the men and events of that period was extremely happy and was listened to very intently. He was followed by Mr. C. C. Adams, of the Postal Telegraph Company, who was recently brought on to New York from Philadelphia, a city which he eulogized eloquently in connection with the Franklin festivities. The proceedings closed with the dispatch of a telegram from the Magnetic Club, signed by President Chandler, addressed to the American Philosophical Society, the University of Pennsylvania and the City of Philadelphia, congratulating them upon the celebration and the great and glorious memory which was thus cherished. The message was entrusted to Mr. Andrew Carnegie as an old telegrapher, and as one active in the exercises of the Franklin Bicentennial, as Lord Rector of St. Andrews University, Scotland.

Gift of International Electrical Congress to American Institute of Electrical Engineers.

Following is a copy of the letter of President Elihu Thomson, of the International Electrical Congress of St. Louis, 1904, transmitting to the American Institute of Electrical Engineers a check representing the balance of money remaining on hand after discharging all of the obligations of the congress:

"I beg to enclose a copy of the treasurer's statement which is being forwarded to all of the members of the International Electrical Congress of St. Louis, 1904. The balance in the treasurer's hands at his date is $2,052.67, a check for which is also enclosed. After consultation by correspondence with all of the members of the executive committee of the congress, it has been decided to offer this sum as a gift to the American Institute of Electrical Engineers for its library. The offer is that the gift shall form a separate perpetual fund to be invested by the Institute in such a manner as it shall deem proper, the annual proceeds of the fund to be expended in the purchase of international electrical literature for its library. By courtesy the American Institute of Electrical Engineers would probably apply the proceeds to foreign or non-American electrical literature.

"Since the American Institute of Electrical Engineers was so closely associated with the International St. Louis Congress in formation, membership, attendance, papers and success, it is hoped that your acceptance of this residual fund may constitute a suitable permanent memorial of the International Electrical Congress of St. Louis, and may also serve as an indication of the perpetuation of that friendly feeling between international electrical workers, that he congress evinced."

At the last meeting of the Board of Directors of the American Institute of Electrical Engineers, the gift of the congress was formally accepted, and resolutions adopted to the effect that the fund shall be known as the "International Electrical Congress of St. Louis, 1904, Library Fund," and that the annual income shall be expended in the purchase of foreign or non-American electrical literature for the Institute library. The fund which now amounts to $2,067.06, has been deposited in a trust company under the conditions indicated above.

Legislation to Limit Niagara Power.

The Burton bill now before the House of Representatives imposes a sharp check on the utilization of the Niagara River by new companies and would submit existing enterprises to the operation of revocable permits. It has been introduced by Mr. T. E. Burton, chairman of the committee on rivers and harbors. At Washington on April 16, a plan to retain the beauty of Niagara Falls and yet permit great power to be taken from the Niagara River, was presented before this committee on behalf of the Niagara County Irrigation and Water Supply Company. The occasion was a hearing on the Burton bill to preserve the falls. The Niagara Company has a State charter, authorizing it to take an unlimited quantity of water from the river for the development of power.

Mr. H. L. Cooper, in charge of the engineering features of its plant, presented a plan to increase the amount of water going over the American side of the falls, and at the same time permit the use of such water as his company would need. This plan was to lower the bed of the river for a short distance above the falls, and so draw water from the Canadian side. He said there could be no objection from Canada, as the treaty now in force provides for an equal division of the water, and the Canadian side now has greatly over half the flow.

Mr. M. A. Viele explained that while his company had a right to unlimited use of the water, it contemplated using only 17,000 cu. ft. per second. From this 450,000 horse-power could be developed. Industries which would depend on this power, he said, would furnish employment to 228,000 men and yield in gross annual products $514,000,000.

Mr. W. J. Clark, in this connection, has also addressed to Mr. Burton an open letter in regard to the value and importance of the power, and its bearing upon the industries of the country. He points out that the 2,000,000 horse-power estimated as possible of development, in the report of the American section of the International Waterways Commission, could be shown by available figures to have a prospective value of $900,000,000 as the saving over equivalent production by steam. This is nearly equal to the value of all the farms in the State. The value of the coal produced annually in Pennsylvania is $121,832,539. It reduced to that extent the value of the resources of the State and marred the landscape of some of the best American scenery. "Would it not, therefore, be as proper to agitate the abandonment of mining in these localities as to refrain from utilizing nature's gift of more than the equivalent of coal at Niagara." Mr. Clark pointed out that the "scenic agitation" was proving very helpful to the commercial interests of the Dominion, as against those of the United States, and that the concession of 17,500 cu. ft. more of water withdrawal to Canada than is granted to America, at $22.50 per hp-year, already meant an annual concession of $4,725,000. Mr. Clark's letter contains a variety of other interesting and striking data.

Directed Wireless Telegraphy.

At a recent meeting of the Royal Society (London) Dr. J. A. Fleming communicated a paper by G. Marconi dealing with methods whereby the radiation of electric waves may be confined mainly to certain directions, and whereby the receptivity of a receiver may be restricted to electric waves emanating from certain directions. For the usual vertical antenna there was substituted a straight horizontal conductor placed at a comparatively small distance above the surface of the ground or water. In some of the tests the transmitting conductors consisted of horizontal wires, the radiations being received at a distance by means of the usual vertical wires suitably attuned. In other tests both the transmitting and the receiving conductors consisted of horizontal wires, while in additional tests the transmitting conductors were vertical and the receiving conductors horizontal. In each case the signals were inaudible when the horizontal conductor was placed at right angles to a line joining the transmitting and receiving stations, and they reached a maximum when the horizontal conductor was placed directly in this line.

Patents on the Tantalum Lamp.

Three United States patents issued April 10 to W. Von Bolton, of Berlin, Germany, deal with tantalum lamps, and are of exceptional interest on account of the information which they contain and of the seeming broadness of the claims. Two of the patents, the applications for which were filed on May 31, 1902, relate to the use of a ductile metal of the vanadium group as a filament for an incandescent lamp, while the third patent, the application for which was filed on January 5, 1904, relates to a special form of substantially pure tantalum.

In order to obtain a coherent metallic body of metal of the vanadium group, the amorphous powder of the impure metal is mixed with paraffin as a binding substance. The plastic mass is then pressed into the desired shape. The resulting body is placed in an oven to drive out the binding substance. The body is then heated by means of the electric current in the absence of air, in order to form a homogeneous ductile metallic body. It is stated that the use of a binding substance may conveniently be avoided by condensing the amorphous powder under sufficient pressure.

For the purpose of obtaining tantalum in a ductile state, the compressed powder of the metal is secured between clamps of tantalum which are connected to the terminals of a source of electrical energy. The metal commences to fuse as soon as an electric current of sufficient intensity is passed through the compressed powder, and molten beads drop off as the fusing proceeds. The fusing process is conducted in a vacuum as perfect as can be obtained. It is stated that if pure raw material is used for the purpose and if all impurities are kept away during the fusing process, the tantalum metal so obtained will have such a high degree of ductility that it can be rolled into very fine sheets and drawn into the finest of wires.

The strength of the patents may be learned from two of the claims, which read as follows: "An incandescing body for electric glow lamps, consisting of a drawn wire of metallic tantalum." "Substantially pure metallic tantalum possessing the qualifications of homogeneousness and ductility."

Development of Wireless Telegraphy.

Some interesting data were given as to the growth of wireless telegraphy by Mr. John Bottomley this week, to the Marconi stockholders at their annual meeting. During the twelve months ending January 31, 15,076 messages, comprising 203,276 words, were sent and received by the American company alone and through its ship and shore stations. During the same period, 1904-1905, 8,314 messages containing 122,424 words were sent and received. These figures do not include the operations of the stations controlled by the English, Belgian, French, Canadian and Italian allied companies.

The completion of the new station at Sea Gate in January last gives an unbroken chain of stations owned and controlled by the Marconi system from New York harbor to Cape Race, N. F., by means of which vessels entering or leaving New York harbor are in constant communication day and night for about seventy hours. Thus, a vessel outgoing, on leaving her dock, takes up Sea Gate, carries this station until communication is established with Babylon, carries Babylon to Sagaponack, Sagaponack to Nantucket, Nantucket to Sable Island, Sable Island to Cape Race. Each of these stations is connected with the land lines so that messages are sent to or received from every part of the United States, Canada, and, indeed, the world.

The long-distance station at Cape Cod has transmitted and received many messages across the ocean without any relay whatsoever. News and commercial messages are constantly transmitted from this station to vessels, 1,700 miles away. At present out of about 70 vessels trading regularly across the Atlantic, which are equipped with Marconi instruments, thirteen are fitted with long-distance receiving apparatus. It is predicted that in a very short time these vessels will be in constant

communication with land during the entire trip across the ocean.

Mr. Bottomley referred to the success which Mr. Marconi has had in transmitting wireless telegraph signals in a predetermined direction. Recently at Clifden, Connemara, a horizontal wire 230 metres in length was laid on the ground and connected at one end to a magnetic detector and to earth. With this wire it was possible to receive with clearness all the signals transmitted from the Poldhu station (about 300 miles away), provided that the free end of the conductor pointed directly away from Poldhu. No signals could be received if the horizontal wire made an angle of more than 36 degrees with the line of direction of Poldhu. Other important tests were carried out with the co-operation of His Majesty's ship Furious. At Poldhu eight horizontal wires 60 metres in length were disposed radially at about two metres above the ground. By means of a switch any one of these wires, which divided a circle into eight equal parts, could be connected to a magnetic receiver.

The Furious, which was fitted with the usual vertical aerial, followed a course describing an arc of about 180 degrees round Poldhu, at distances up to sixteen miles. By means of a horizontal wire arrangement the bearing of the ship from Poldhu could be determined at any time by noting on which particular wire or wires the reception of signals was strongest, and also by observing which wires were non-receptive. It was also found possible to receive simultaneously, and without mutual interference, different signals sent by means of oscillations of the same wave length coming from the ship and from the Lizard wireless station whenever the position of the ship was such that a line drawn from it to Poldhu made an angle of at least 50 degrees with the bearing of the Lizard station.

Undeveloped Water Powers in Newfoundland.

We have received from Rev. P. J. O'Brien, of Mobile, Newfoundland, a communication pointing out the great opportunities for water power electrical generation in the district in which Mobile is situated.

In the neighborhood of Mobile there is a water shed of about 100 square miles with three outlets, two being immediately into the sea, and one about 1½ miles, passing through the village of Mobile. The water pocket or reservoir of the latter is at least 15 square miles. A comparatively small outlay would double the quantity of reserve water, while a small dam would give an immediate drop of 100 ft. if an angle of 45° or less. From the power site to the settlement is a plain inclined about 50 ft. for 1½ miles to the harbor. The second outlet could be developed at a small outlay, and though the watershed is not more than ten square miles, the reserve water is considerable and would be capable of doing much work. The third outlet drains an area of about 35 or 40 square miles, 20 square miles of which could be converted into a reservoir. The outlet here is immediately into the sea through a narrow chasm in a cliff which is at least 150 ft. high. There is abundant material on the spot for damming the outlet. The greatest drop here would be about 100 ft. and the least 50. The basin would give an average depth of 80 or 90 ft. of water.

At the very outlet of this last watershed there is a large slate quarry of superior quality. Experts have pronounced it the right material for marbleizing purposes. Current could be generated for the lighting of the coast by electricity instead of oil lamps, the lighting of the city of St. Johns, as well as the running of all its machinery. The Reid Railroad Company now runs electric cars and does a little lighting, but its power cannot do more. A competitor with the water power above referred to in his possession would soon control the situation. The day is fast approaching when a railway must run from St. Johns to Trepassy and St. Marys. Trepassy is about 70 miles from St. Johns and St. Marys about 15 miles further on, the principal town of a bay of the same name. All this 1,000 square miles of country is between St. Johns, the capital, and Bay Bulls, a seaport town about 18 miles in a southern direction and the nearest port to St. Johns, while Trepassy is a magnificent seaport on the most southwesterly extremity and capable of holding the entire British navy. St. Marys lies in a northwesterly direction about 15 miles. An oblong about 16 by 70 miles would embrace the whole area. The harbor of Trepassy is the nearest post of call for transatlantic shipping, is accessible at all seasons and in all weathers, while St. Johns is often blocked with ice and is not always accessible. It would shorten the time considerably for freight and passengers to go through the island while avoiding the dangers of Cape Race.

A railway to Trepassy is a matter the government will have to tackle in the near future. This prospective line would run through a picturesque country, while the numerous lakes would suggest sites unequalled for private residences. Travelers who have visited this country in summer time have been lavish of praise for the abundance of hunting and fishing opportunities, while the climate (heretofore so grossly misrepresented) is among the most bracing and enjoyable on earth.

Father O'Brien states that he has applied to the government for rights to control the use of the water powers noted. Bog and stone grants can be obtained when the time is opportune.

Motors in Rolling Mills.

In a paper on "Electric Motors and Their Applications," read before the Engineers' Society of Western Pennsylvania, W. Edgar Reed refers to the progress made in the introduction of electric drives in rolling mills. He stated that in addition to the auxiliary apparatus, motors are now also being used to drive some of the rolls of steel and iron mills. Eight and a quarter-inch rolls at the Remschied Works are driven by 100 hp 225 to 350 revolutions per minute motors for rolling tool steel from 1½-in. section bars. Compound motors of 1,200 hp are now being installed at the Phœnix Mills, also in Germany, for reversing rolls. A 1,500-hp motor has been in use at the Pittsburg Reduction Company's works for several months for driving rolls. Two 1,500-hp, compound-wound, 100-r.p.m. motors, suitable for 25 per cent increase in speed, are now being installed at the Edgar Thomson Works of the Carnegie Steel Company for the driving of rolling mills.

In cases where the voltage regulation must be fairly good a system similar to the Ilgner system, which has been used in Germany, can be applied. This is also applicable to hoisting and similar work. The Ilgner system is somewhat similar to the Ward Leonard system, with the addition of a flywheel, and consists of a motor generator set, with a heavy fly wheel mounted on their common shaft. The motor can be either alternating or continuous current, having the compound characteristics so that the flywheel will take the overload. The motor is connected directly to the supply circuit. The generator is a compound-wound continuous-current machine, the field coil receiving current separately from a machine mounted on the motor-generator shaft. The generator current is used for operating a continuous current motor which is connected to the rolls and is excited from the generator exciter. The speed of the motor can be changed by varying the exciting current of the generator. The efficiency of this system even at low speeds is very good. It can be applied when it is necessary to reverse the rolls, as it is only necessary to reverse the generator field to reverse the direction of the roll driving motor. The above system is now used for operating 18-in. rolls at the blooming mill of the Bethlen-Falva Iron Works (Germany). The motor has a capacity of 600 hp at 5,800 volts, 50 cycles, 16 poles. The generator (good for 100 per cent. overload) has a capacity of 500 kw at 510 volts, 300 to 365 r.p.m. The flywheel weighs 20 tons and it absorbs 16,000 hp seconds when the speed changes from 300 to 365 revolutions. The roll driving compound motor has 200 hp normal and 600 hp overload capacity and runs at 60 to 110 revolutions. A 12-ton flywheel is mounted on this motor shaft. The roughing mill has 14-in. rolls and is driven by a motor having the same capacity as the blooming mill motor, but runs at 150 to 230 r.p.m. approximately, and has an 8-ton flywheel. It is stated that the load fluctuations at this plant are very small, and constant power is taken from the supply mains.

CURRENT NEWS AND NOTES.

NEW YORK ELECTRICAL CLUB.—To mark the opening of the New York Electrical Club, a reception will be held in the handsome club rooms at 16 Park Place, on Saturday, April 21, between 2 and 4 p.m.

ONE THOUSAND STRONG.—The National Electric Light Association expects to have a full thousand names on its membership list at the time of the Atlantic City meeting, June 5 to 8. Only thirty more are needed to make up this number, and at the rate applications are coming in there is no doubt of the full number being reached. The growth of the Association has been extremely rapid during the last four years.

APRIL A. I. E. E. MEETING.—At the regular monthly meeting of the American Institute of Electrical Engineers, to be held April 27, two papers will be presented dealing with high-tension underground cables as follows: "Standard Dies, Rubber-Covered Wires and Cables," by Mr. John Langen; "Comments on Present Practice in Underground Cable Work," by Mr. Wallace Clark. The annual business meeting of the Institute will be held May 15, but no papers will be presented at this meeting.

GREAT INVENTIONS FOR SALE.—Mr. C. L. Staub, architect, of Omaha, Neb., has issued a circular to all and sundry offering "four great inventions for sale." One of them is a steam boiler with a fuel saving of 400 per cent. Another is "a new motor to produce electricity or run dynamos by reharnessing the lost 85 per cent of coal power that now goes out of the chimney." The others are not less important. Original drawings of these revolutionary improvements can be had for from $100 to $300, and the whole thing, lock, stock and barrel, can be had for the absurdly cheap price of $150,000. The inventor gives highly adequate reasons, however, for his willingness to accept this paltry sum. He says that he wrote to Mr. Edison on the subject some weeks ago, but got no reply; "and now I am going to make him look small." God speed the day!

PAINTING INSULATORS RED.—The subjoined extraordinary bill has been introduced in the New York State Assembly by Mr. A. E. Smith and referred to the Committee on General Laws: "An act to provide for better security of life, in erecting electric light wires. Section 1. Every person, company or corporation owning, controlling, maintaining, erecting or repairing any wire used for electric light purposes, or for the purpose of conducting electricity, where such wire is suspended from poles or strung from cross arms upon poles, shall attach such wire to such poles or cross arms by insulators made of glass distinctly red in color. Section 2. Every person, company or corporation, its agents or employes, not complying with the provisions of this act shall be deemed guilty of a misdemeanor, and liable to a fine of not to exceed two hundred and fifty dollars for each offense. Section 3. This act shall take effect immediately."

THE GREENWICH MERIDIAN.—A special dispatch from London of April 9 says: "The electrification of London, which is progressing rapidly under the County Council's direction, threatens to interfere with the accuracy of the world's chronometers. At Greenwich the council has erected a huge generating station, and one of the smokestacks is placed right in the plane of the meridian of Greenwich, by which the clocks of the world are set. It is feared that smoke from the stack will obscure the view of the great telescope by which the observatory staff observe the stars as they cross the hair line drawn on the lens and thus fix the universal standard of time. In another way the electrical installation which runs the street cars at Kew, in the other extremity of London, has so seriously affected the instruments at the observatory in Kew Gardens, that it has been decided to remove it to a spot less influenced by electricity. Greenwich observatory, however, will remain where it is, and if the smoke proves an insuperable obstacle the smokestack will be removed, for it can be imagined that the abandonment of the Greenwich meridian as a standard of time would lead to incalculable confusion throughout the world."

FRANKLIN DAY HONORS.—In connection with the celebration of Franklin day in Philadelphia on April 17—the day of Franklin's death—commemorating also January 17, the day of his birth, the University of Pennsylvania is conferring several degrees this week. King Edward, through Sir Mortimer Durand, the English Ambassador, will receive the degree of Doctor of Laws from the University on Thursday, and the university, of which Franklin was one of the founders, will also confer other honorary degrees upon the following persons, among others: Andrew Carnegie, Sir George Howard Darwin, Plumian Professor of Astronomy and Experimental Philosophy, University of Cambridge, England; Guglielemo Marconi, inventor of wireless telegraphy; Ernest Rutherford, Professor of Physics, McGill University, Montreal; John William Mallet, chief chemist, University of Virginia; James Gayley, New York, metallurgist and first vice-president of the United States Steel Corporation; Edward Charles L. Pickering, Professor of Astronomy, Harvard University; Alois Brandt, Royal Academy of Science, Berlin; H. A. Lorentz, a distinguished physicist of Holland; Dr. Edgar F. Smith, president of the American Philosophical Society. As noted elsewhere, Mr. Andrew Carnegie, acting in his official capacity as Lord Rector of the University of St. Andrews, in Scotland, conferred the degree of Doctor of Laws upon Miss Agnes Irwin. Miss Irwin is a dean of Radcliffe College, the woman's annex to Harvard University. She is a great granddaughter of Benjamin Franklin. Her mother was Sophie A. Bache, a daughter of Richard Bache, who was a son of Sallie Franklin.

PUBLIC SERVICE COMMISSIONS.—President A. C. Humphreys, of the Stevens Institute of Technology, took occasion at the annual dinner in New York City of the civil engineering graduates of Columbia University to animadvert on the manner in which the New York State Commission on Gas and Electricity was formed, and the treatment accorded the Consolidated Gas Company. "First, an investigation was had by a committee from Albany. This is generally spoken of as a 'most thorough investigation.' The thoroughness is seen when we find that upon the recommendation of this committee a law was passed requiring the company to distribute its product under conditions that would in the effort to conform thereto unnecessarily deprive the consumer of a satisfactory supply. The company would even be subject to $1,000 fines as often almost as the authorities cared to make the inspections. As a result of this investigation, which was so remarkable for its completeness, a law was passed to place this industry under the control of a commission. The business being one of much complexity, it was reasonable to expect that the Governor would try to appoint, not only able and reputable men, but men already qualified to deal with problems to be presented—men not subject to political pressure. The undertaking was a difficult one even for a competent board—competent, I mean, by reason of past training along specific lines. As nearly every branch of engineering is involved, should we not expect that on such a board there should be at least one engineer? As many questions of business policy and management are involved, should we not expect that there should be at least one member with broad business experience? No—all three appointees were lawyers, and all three, apparently, subject to political pressure. Speaking from a fairly full and broad experience in such matters, I deliberately express the opinion that if such a board is to be recruited from one class or profession only (though there is no necessity for such a course), a better result could be obtained from a board composed of three engineers than from one composed of three lawyers, and especially if these engineers were acountant engineers. In this case the course pursued was the more definitely open to criticism by the Legislature which passed the law and the Governor who appointed the members of the board put pressure upon the board to render a decision while the investigation was not yet completed. Finally, the Legislature took the matter out of the board's hands by passing a bill to cover some of the cases still under advisement."

AN ELECTRICAL SHOW has been given this month in Salt Lake City and the display is spoken of by the local press as large and interesting. A system of colored incandescent lamps was employed to show the telephone system through the intermountain country. Electric heating and cooking were also very much in evidence.

RUSSIAN ELECTRICAL ENTERPRISES.—Permission to use waterfalls in the rivers Narova and Vouchsa in Finland for power purposes has been granted to a company formed with $15,000,000 capital. The plan is to supply St. Pettersburg with electric power. A concession has been sought for an electric railway between St. Petersburg and Moscow.

SALE OF GOVERNMENT LINE.—Bids have been asked for by Lieut. J. S. McCleery, chief signal officer of the Department of the Colorado, for the sale of seventy-three miles of Government telegraph line between Price and Mytton, rendered unnecessary by the building of the Mack-Dragon Railroad. All Government stores are now diverted from the old wagon road to the railroad, which also has a telegraph line to Duchesne.

OWNERSHIP IN ENGLAND.—Hon. R. P. Porter states as to the values of public service systems in England that in the case of gas undertakings the capital invested in them is in the proportion of $192,500,000 municipal and $345,000,000 private enterprise, ascending and diminishing figures, respectively; in the case of electric lighting undertakings, $178,500,000 represents municipal and $159,500,000 private capital, while in the case of the street railways or tramways the division of capital is $155,740,000 municipal and $464,300,000 private companies.

ELECTRICAL REFRIGERATION.—Mr. J. T. Matthias, who is in charge of the electrical refrigeration branch of the Philadelphia Electric Company, as already noted in these pages, makes an encouraging report as to new business in that field. He has added to the circuits since January three 30-hp, two 15-hp, one 10-hp, one 5-hp, one 3-hp motors for this service and has good prospects of closing one 50 and one 20. These figures are a good indication of the possibilities in a new department of energy consumption.

LICENSING ELECTRICAL CONTRACTORS.—A bill has been passed by the last Maryland Legislature requiring all electrical contractors in Baltimore to be licensed. The bill further provides for the creation of a State Electrical Board, consisting of three members, one to be appointed by the Electrical Association, one by the building inspector of the city and one by the Governor. This board is to have the power of issuing to all electrical contractors a license to carry on business in the city of Baltimore after their qualifications have been passed upon.

CANADIAN NIAGARA POWER.—The Canadian section of the International Waterways Commission states that to the 415,000 hp to be developed by the works of the three companies now in progress on the Canadian side, from 200,000 to 400,000 additional horse-power can be developed without in any way impairing the beauty of the falls. It is recommended that until the consequences of the works actually under construction are known no arrangement whatever be made with the United States Government; and the assertion is made that if the falls are impaired in beauty to-day the mischief is done on the American side, as the power companies on the New York side have their intakes above the rapids at which the falls commence. On the other hand, not one of the three Canadian companies has an intake above the rapids. It is also recommended that as the demand for power from the Canadian companies will be limited for some time, it would be good policy not to permit any other companies holding Canadian charters which have not yet begun operations to proceed with their work, but that their charters be cancelled and none others be granted until the actual condition of affairs as shown by the completed works of the present companies is known.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—The regular monthly meeting of the American Institute of Electrical Engineers will be held in the assembly room of the New York Edison Company, No. 44 West Twenty-seventh Street, New York City, on Friday, April 27, at 8.15 p.m. The following papers will be presented and discussed: "Standardizing Rubber-covered Wires and Cables," by John Langan, New York; "Comments on Present Underground Cable Practice," by Wallace S. Clark, Schenectady, New York.

FIVE THOUSAND BATTERIES GONE.—The Western Union Telegraph Company is overhauling its office and system in Salt Lake City, and one of the changes is that of throwing out 5,000 cells of good old crowfoot battery and substituting the now familiar dynamo and motor-generator equipment, connected into the local supply circuits with a gas engine as reserve. All the new circuits are of copper, 210 lb. to the mile. It is stated that the battery maintenance was $1 per cell, whereas the energy from the Utah Light & Railway Company will cost only $1,500 to $2,000 a year.

THE WORD "ELECTROCUTE."—A rather strenuous letter has been contributed to that great national cloaca of complaints, the London *Times*, by Prof. Churton Collins, objecting to the sweet word "electrocute," which he accredits or discredits to American journalism. He says: "May I venture to enter a protest against the latest hideous importation from American journalism? The monstrous word 'electrocute,' for kill by electricity, is now of regular occurrence, and bids fair to become part of our language. When we have the legitimately formed word 'electrocide' at our service why should it not be adopted and so detestable a solecism as the word referred to be repudiated?" But other correspondents did not agree with him at all. "Is it not surprising," asks one, "to find Prof. Churton Collins recommending to us as a legitimately formed word of such a barbarous Greek-Latin hybrid as 'electrocide' would be? It would be as bad as 'automobile.'" *"Quis custodiet?"* cries another. "'Electrocute' may be a detestable solecism, 'electrocide' may be a legitimately formed word, but 'electrocide' could not carry legitimately the desired meaning. 'Electrum' meant to the Roman simply 'amber' or 'a mixed metal resembling amber in color.' Even if 'electrum' has been used as the foundation of the word 'electricity,' 'electrocide' would, on the analogy of 'parricide,' be a person who kills electricity." In America, as the practice was first recommended by Mr. E. T. Gerry, there is an idea that "gerricide" would meet the needs of the situation.

TELEPHONY IN NEW YORK.—If the plans of the Atlantic Telephone Company go through, New York City will have presently an automatic telephone exchange service. After six months of proposal and counter proposal, franchise terms have been agreed on between the legal representatives of the Atlantic Telephone Company and Harry P. Nichols, chief of the Bureau of Franchises of the Board of Estimate. Under the agreement the company will pay to the city an aggregate of $3,000,000 as a minimum for a twenty-five-year grant. The matter will be laid before the Board of Estimate on April 20 for its action. In addition to the cash compensation for the franchise the Atlantic Telephone Company agrees to furnish to the city free telephone service for all departments in all boroughs, exclusive of long-distance calls. This, it is agreed, is to go in the contract. The company also guarantees a five-cent interborough rate to all pay station users and to private subscribers. Connection with the independent exchange at Elizabeth and thence with the Keystone Telephone Company in Philadelphia also is a part of the contract guarantee. The backers of the Atlantic Company are Joshua D. Powers, president of the United States Trust Company, of Louisville; Edward L. Barber, of the banking firm of Barber & Brailey; L. T. Watson, of the banking firm of Watson & Co.; James R. Branch, secretary of the American Bankers' Association, and John M. Shaw, of the banking firm of J. B. Russell & Co., of New York City, which house acts as fiscal agent for the company. It is incorporated for $5,000,000 and an increase of stock to $25,000,000 has been authorized.

NATURAL GAS COMPETITION.—Mr. F. L. Bradley, secretary of the New Cumberland, W. Va., Light, Heat & Power Company, writes us that the company has discontinued business and has dismantled its plant, for the reason that it could not compete with the natural gas which is at present so abundant and cheap in that vicinity.

COPPER AND IRON.—Dr. James Douglas, the well-known metallurgical authority, gives data to show that through a long period of years the consumption of iron and copper in the United States has maintained a standard relativity. In other words, for the last decade the consumption has been at the rate of one ton of copper to 83 tons of iron. It has never fallen below 1 to 80 or risen above 1 to 87. In 1905 the amount of copper consumed in the United States reached the gross total of 262,678 tons.

TUNNELS AND TRAFFIC.—The directors of the Pennsylvania Railroad Company have authorized President Cassatt to enter into an agreement with the Hudson River Tunnel Company for the joint use of the railroad company's right of way between Jersey City and Newark. It is the initial step toward an extensive electric rapid transit system between the two cities. Under the terms of the contract to be entered into by the two corporations, the Hudson River Company is to build an electric railway between Newark and Jersey City. The tracks will parallel the Pennsylvania's tracks into Jersey City. They will then descend into the McAdoo tunnels to New York.

TROUBLES AT BAY CITY, MICH.—The superintendent of the Bay City, Mich., municipal lighting plant has filed a report with the City Council stating that 120 arc lamps are out of service on the east side of the river and that "this condition is liable to exist for a period of four to six weeks, due partially to the red tape methods we are compelled to pursue and to the condition of the dynamos." The superintendent proposes that all this plant should be scrapped and new bought. On the west side the commercial service is in bad shape, as the dynamo on it heats up badly and will not carry its load. "To attempt to operate the plants and do it successfully is an impossibility as they are."

STEAM TURBINE UNDER EXHAUST PRESSURE.—The Home Lighting & Heating Company, of Springfield, Ohio, which has a plant in the business district of that city, and does exhaust steam heating, completed recently the installation of a 500-kw Westinghouse steam turbine. This turbine operates under from 3 to 7 lb. exhaust pressure during the heating season. Although steam turbines have been considered very uneconomical under such conditions, the Springfield company regards this use fully justified because of the economy in room and the absence of necessity for cylinder oil. The plant is in a location where room is very valuable, and extensions of the building are not possible on the present property.

NEW LAWS IN OHIO.—Several measures of importance to Ohio lighting companies were passed by the recent Ohio Legislature. The most important of these was the Hillenkamp bill which gives a city council the right to grant a franchise to a competing company and rendering it unnecessary to secure a two-thirds majority vote of the people before such a grant could be made, as has been the rule in the past. This measure was instituted in the interests of a company which for some time has been seeking a grant in Toledo to compete with the Toledo Railways & Light Company. It will also work to the advantage of several competing companies in Cleveland. The Bradley Light, Heat & Power Company and the Cuyahoga Light & Power Company of that city last year made application for franchises, but they failed to get the necessary two-thirds majority vote of the people. Now they will go after the council with their propositions. Another measure authorizes the levy of a five-mill tax to aid in supporting municipal lighting plants where the receipts of these plants are insufficient to pay expenses. The Smith bill provides that councils granting franchises to lighting companies may stipulate that meters shall be furnished free of charge.

LONG ISLAND ELECTRIFICATION.—In the Long Island Railroad Company's annual report, just published, President Peters calls attention to capital expenditures during 1905 aggregating $6,737,568, of which the principal item was $3,545,583 for electrification of steam lines. President Peters says: "Your company has largely completed the electrification of its lines in and adjacent to the boroughs of Brooklyn and Queens, and at the close of the year had in operation electric train service between Flatbush Avenue and Belmont Park, Woodhaven Junction, Rockaway Park, Hammels, Valley Stream and Far Rockaway, and Jamaica and Springfield Junction, a total of 96 miles of single track, with 172 scheduled trains daily. The operation has been carried on very successfully, but is not as yet on an economical basis."

CELEBRATION AT CHARLOTTE.—The city of Charlotte, N. C., is to celebrate on May 20, being the anniversary of the famous Mecklenburg Declaration of Independence. An elaborate electrical display is to be given May 21-26, and Mr. C. E. Bradshaw, the city electrician, invites co-operation on behalf of the electrical committee. He says: "We expect to have a big demand for lighting novelties, etc., and cordially invite the electrical trade to enter their goods, such as fittings, lamps, etc., and we can probably furnish quarters free. The electrical committee will take care of them if the owners do not care to send a representative, receiving the goods, storing, setting up and running and returning them to the owners. All current will be furnished free in reasonable quantity. As this will be of benefit to the electrical trade in general it will be to the advantage of all the manufacturers and dealers to make as good a show as possible."

DEFECTIVE FIRE ALARM SYSTEM.—None too soon an appropriation of $1,625,000 to be secured from city stock is asked for the fire alarm system of New York City. Fire Commissioner O'Brien calls attention to an investigation made by the Board of Fire Underwriters, whose experts, Messrs. Kempster B. Miller and J. J. Carty, "reached the conclusion that the total cost of an adequate system of fire alarm telegraph protection for the Borough of Manhattan would be about $1,625,000, exclusive of the ground for the central office." No estimate for the central office was submitted, for the reason that the price would be subject to variation, depending upon location. The Commissioner's letter to the Board of Estimate concludes: "After giving to the matter careful consideration, I have come to the conclusion that the issue is of such vital importance to the public welfare that immediate action should be taken, looking to the replacing of the present fire alarm telegraph system in the Borough of Manhattan with a modern and up-to-date system commensurate with the requirements of the situation."

TELEPHONE COMPETITION.—The New York Telephone Company has just issued for general circulation a pamphlet based chiefly on data collected by the Merchants' Association of New York and dealing with the practical results of telephone competition in various American cities. A large amount of other data is also given bearing upon the same question, i. e., the operation of two competing telephone systems in any city, and there are tables and diagrams relative to this important matter. The case is thus summed up: "These are cases in which an almost nominal increase in the total number of telephone users has afflicted the business community with a heavy burden of double charges. Although in many other cases the body of exclusive users of independent systems is a larger proportion of the whole, and in some instances the majority, the duplications, representing payment of double charges in order to obtain communication with two isolated groups of telephone users, are in all instances a large proportion of the whole, and in most cases represent payment of the maximum charge. Although the amount of wasteful outlay thus entailed by compulsory duplication of telephone systems can only be conjectured, it is probably more than one-half of the entire amount paid annually for the service of the independent companies. Evidence is abundant to show that where rival systems exist the use of both by the business community is compulsory."

Hydroelectric Development in the Adirondacks.

RAQUETTE RIVER falls 385 ft. along its course of five miles below Colton Village, N. Y., and at the foot of this descent the combined electric power house and pulp mill of the Hannawa Falls Water Power Company is located. At this power house spruce logs are ground into wood pulp, and electric energy is developed for transmission to Ogdensburg and other points more than thirty miles distant. When the water is not wanted to drive the electric generators, it is turned into the wheels that operate the pulp grinders, and the problem of a variable load factor is solved.

The importance of this plan for the double use of water power may be gathered from the fact that the power house named is designed to utilize 84 ft. of the fall in the river, that the rate of river discharge sometimes falls as low as 1,000 cu. ft. of water per second, and that the total rating of turbine wheels used to operate the electric generators and pulp making machinery is fully twice as great as the net power that this quantity of water will develop. Managers of electric power stations in regions where wood pulp can be made to advantage may perhaps draw a valuable lesson from this example.

Above the dam at Hannawa Falls, the drainage area of the Raquette River is 953 square miles, and most of this lies in the great lake and swamp region of the Adirondack Mountains, at elevations of 1,000 to 1,700 ft. above sea level. In this region and forming a great storage reservoir from which the Raquette

FIG. 1.—TAILRACE.

River flows, are the Tupper lakes, Long Lake, Raquette Lake, Brandreth Lake, and a score or more of small lakes and ponds.

Having left this region of swamps, lakes and mountains some miles behind, the Raquette River reaches the head of the great falls at Colton with a surface elevation of 800 ft. above sea level, and from this point its descent of 385 ft. in five miles begins. Along this part of the Raquette the water rights have been acquired by the Hannawa Falls Water Power Co., but only the lower 85 ft. of the total fall in this five miles of the river has thus far been developed.

The present hydraulic development begins with a dam at the village of Hannawa Falls, which sets the water back for a distance of 2.5 miles, and forms a pond with an area of about 200 acres. From this dam a canal some 2,700 ft. long carries the water down stream to a forebay above the power house on the river bank. The head wall of this forebay is pierced by four steel penstocks that run underneath the power house, and rise to its several sets of turbine wheels.

At Hannawa Falls, the dam across the Raquette River is built where the bed and perpendicular banks were of sand-

FIG. 2.—FOREBAY, PENSTOCK AND POWER HOUSE.

stone, and the distance between the latter was about 375 ft. Between its main abutments or wing walls the river section of the dam is 258 ft. long and rises to a maximum height of 40 ft. above the bedrock. Of this river section of the dam, a length of 234½ ft. forms the overflow portion, 8 ft. are taken up by an abutment at one end of a waste gate, and the opening of this gate is 15.5 feet wide.

Adjoining the main abutment that supports one end of the

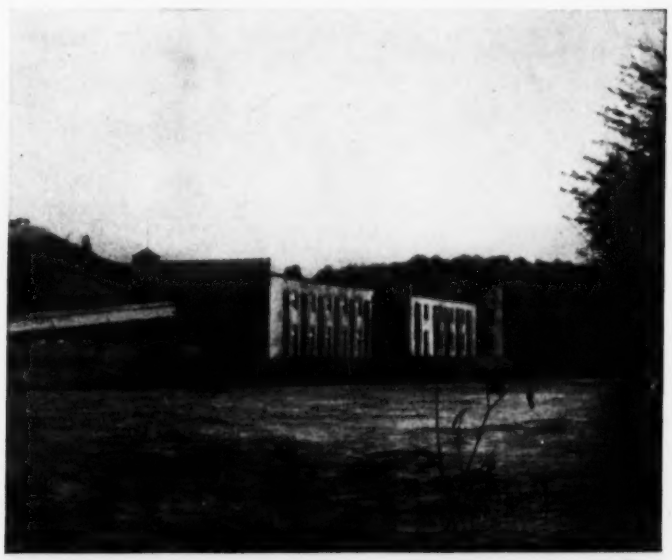


FIG. 3.—POWER HOUSE AND PULP MILL.

waste gate is the entrance to the canal, 80 ft. in the clear, which is spanned by a stone bridge of five arches with four piers, each 4 ft. thick, underneath. The combined width of these openings between the piers and abutments at the head of the canal is thus 66 ft., and the standard width of the canal below its head is 30 ft. at the bottom and 110 ft. at the top, with side slopes of two to one. From the top of its banks to its bottom the canal is 20 ft. deep, and the bottom is 14 ft. below the crest of the overflow section of the dam.

A few feet below the entrance to the canal there is a waste gate and weir, by which the water may be discharged into the river. The 15.5-ft. opening in the river section of the dam is closed by four steel waste gates set in a steel frame, and the sill of this frame is 30 ft. below the crest of the dam. Each of the four gates measures 6 by 8 ft., two of the gates being at the bottom and two at the top of the opening. The two

lower gates are operated by hydraulic cylinders, and the two upper gates are opened by lowering them, so that any desired depth of water may flow over their tops. These large gates were made desirable by the necessity of providing for the passage of logs down stream, and for the purpose of controlling the level of water in the pond.

Beneath the dam very little excavation was necessary, as the beds of sandstone have a large dip down stream, and thus presented a toothed surface of excellent character for a foundation. The thickness of the dam at its base is 25 ft., and a little below the crest it is 7 ft. From base to crest the dam consists of Potsdam red sandstone and cement. On the upstream and downstream faces of the dam a rubble wall at least 3 ft. thick was laid and between these walls the center of the dam was filled with large irregular pieces of sandstone packed with cement concrete. On the downstream side the stones in the dam are laid in Portland cement, and for the remainder of its masonry natural cement was used. The concrete used in the center of the dam was composed of one part natural cement, two parts sand, and four parts broken sandstone.

At its head the canal may be closed by means of stop-gates between the stone piers named above. From these gates to the forebay, on the high bank above the power house, the length of the canal is about 27 ft., and it is designed to deliver 2,500 cu. ft. of water per second, at a velocity of 3 ft. per second. It is expected that when storage reservoirs at the head of the Raquette have been constructed, the river will have a constant discharge of not less than 2,500 cu. ft. per second.

In its general course the canal follows the river, and lies partly in excavation and partly in embankment, with a bed of gravelly loam, sandstone chips, sand and clay. These materials have been so compacted that the canal shows no leakage. At the forebay and along 50 ft. of the canal above it, the bottom is formed with a layer of concrete in which expanded metal is embedded. Beneath this layer of concrete, which is 4 in. thick, there is a layer of clay that has been packed with water, in the forebay. Retaining walls of masonry support the ends of the canal banks at the forebay, and connect with the forebay head walls that receive the steel penstocks. From these retaining walls, core walls of masonry run back some

FIG. 4.—ELEVATION OF POWER HOUSE, STOREHOUSE AND PULP CONVEYOR.

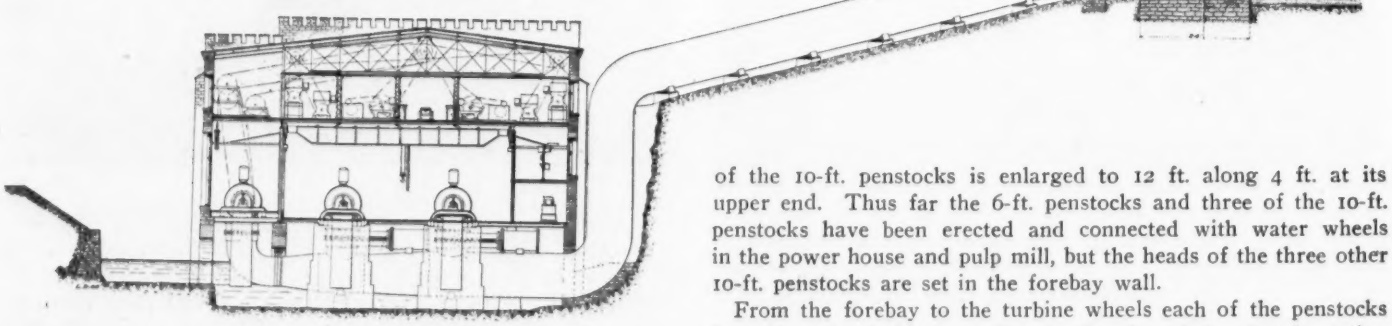


FIG. 5.—CROSS-SECTION OF POWER HOUSE ALONG PENSTOCK NO. 2.

50 ft. into the banks. The head wall of the forebay is built with two faces that unite at a large angle, and one of these faces receives three and the other four, steel penstocks. Concrete with embedded sandstone forms the basis of these forebay walls, their outside is faced with sandstone blocks, and between each two penstocks there is a buttress of stone masonry 4 ft. wide and 2 ft. thick.

At the corners of the buttresses 6-in. x 6-in. angle irons are secured, and serve as guides for the head gates. These gates are of wood and are operated by racks and pinions that connect with a common main shaft driven by an electric motor. In front of the head gates is a steel rack, and all are covered by a wooden building. One of the seven penstocks is 6 ft. in diam-

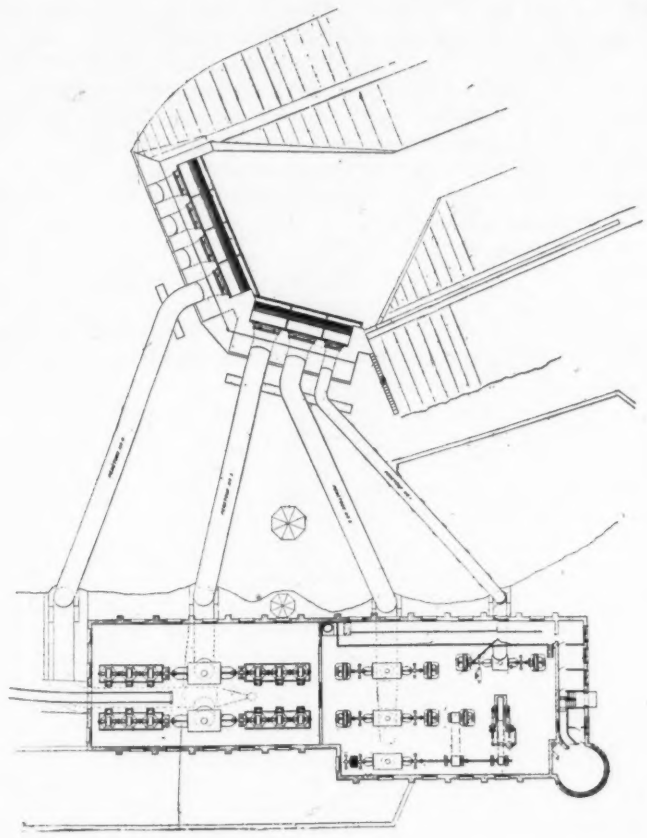


FIG. 6.—PLAN OF LOWER FLOOR OF POWER HOUSE AND PULP MILL, SHOWING ALSO PENSTOCKS AND FOREBAY.

eter, and each of the others is 10 ft., and all are spaced with 18 ft. between centers where they enter the head wall. Each of the 10-ft. penstocks is enlarged to 12 ft. along 4 ft. at its upper end. Thus far the 6-ft. penstocks and three of the 10-ft. penstocks have been erected and connected with water wheels in the power house and pulp mill, but the heads of the three other 10-ft. penstocks are set in the forebay wall.

From the forebay to the turbine wheels each of the penstocks has a length of about 200 ft. At the site of the electric station and pulp mill the surface of the Raquette River is about 75 ft. below the crest of the dam. To take advantage of this condition, a tailrace was excavated from the electric station to a point about 1,100 ft. down stream, and this gives a tailwater level at the station that is about 9 ft. lower than that of the river, just outside of the tailrace wall.

The electric generating station is located over the tailrace, and at the foot of the high bank that carries the forebay.

At its first floor level the station is 72 ft. below the crest of the dam, and 12 ft. above the water level of the tailraces, so that the head on the turbine wheels is 84 ft. The building in which the generating equipment is located measures 250 ft. in

length, 60 ft. in width along one-half of this length, and 75 ft. in width for the other 125 ft. The building is two stories in height. Its walls are of Potsdam red sandstone, its floors of concrete with expanded metal, and its roof of sandstone flags, two inches thick and laid on T irons. That part of the building which is 75 ft. wide, being the up-stream end, contains the electric generating equipment on the first floor. Across the upper end of the building a space 12 ft. wide, and including the tower, is separated from the remainder by a sandstone wall, and used for offices.

The generator room, where the water wheels and dynamos are located, is 115 ft. long, 75 ft. wide, and 22 ft. from floor to ceiling. Over the central part of this floor space travels a hand crane of 48-ft. span and 16 tons capacity, supported by steel columns. All of the second floor of the power house except the office space, and the down-stream half of the first floor, are occupied by machinery for the production of ground wood pulp.

Beneath the floor of the generator room the bedrock is distant some 21 ft., and over this the tail water is 9 ft. deep. Into this space between the station floor and the bedrock of the tail-race come one penstock of 6 ft. diameter and one of 10 ft. diameter, from the forebay above the high bank. The 6-ft.

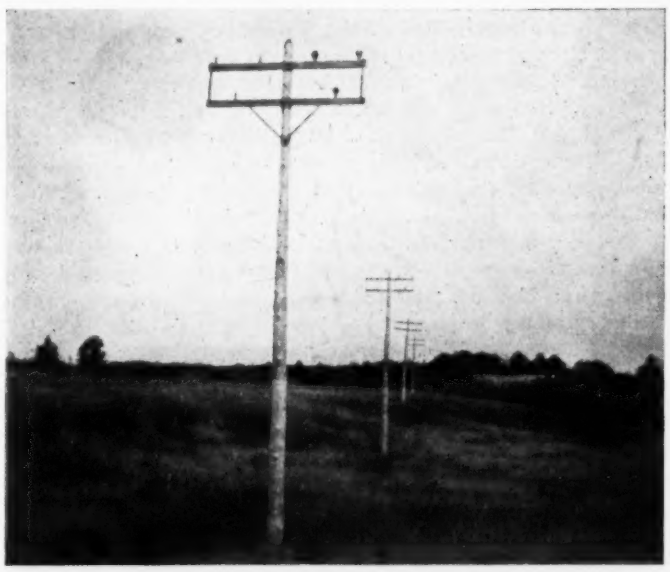


FIG. 7.—20,000-VOLT LINE HANNAWA FALLS TO OGDENSBURG.

penstock rises to the case of a pair of Samson type, outward-discharge turbine wheels mounted on a horizontal shaft and located on the floor of the generator room. Under the working head of 84 ft. of water this pair of wheels operates at a speed which is regulated at about 300 revolutions per minute by a Lombard governor geared to the gate rigging. To each end of the shaft of this pair of turbine wheels a 350-kw, three-phase, 4,400-volt alternator is direct connected. For the pair of wheels the rating is 1,250 horse-power, and the combined rating of the two connected generators is 700 kw., on about 930 hp. The pair of generators just named have been in use several years for the supply of electricity to lamps and motors about Potsdam.

Along that side of the generator room which is nearer to the forebay runs a switchboard gallery 12 ft. wide, and beneath this gallery the transformers for the 201,000-volt transmission line to Ogdensburg and other points are located. The other steel penstock that runs beneath the floor of the generator room has a diameter of 10 ft., and its connections rise to three pairs of horizontal turbine wheels with a rating of 1,500 hp each. One pair of these turbines is belted to an exciting dynamo and an air compressor, and to pulp making machinery on the second floor. Each of the other two pairs of turbine wheels is direct connected to a pair of 350-kw, 4,400-volt, three-phase, 60-cycle General Electric alternators, which have just been installed.

From the 4,400-volt alternators the current goes in part to the transformers beneath the switchboard that raise the pressure to 20,000 volts for the transmission to Ogdensburg and

FIG. 8.—DAM AT HANNAWA FALLS.

Gouverneur. A part of the energy is transmitted at the generator voltage to Potsdam.

On leaving the water power station at Hannawa Falls, the 20,000-volt transmission line crosses the Raquette River, which is some 240 ft. wide at this point. The line then runs to Canton village, a distance of 10.5 miles, and on thence to the city of Ogdensburg, over an additional distance of 19 miles, so that the total length of the transmission in this direction is 29.5 miles. At a distance of about six miles from Hannawa Falls, a branch from the transmission line goes to Gouverneur village, which is some 25 miles from the junction point, so that the length of line from the water power station to this village is nearly 31 miles.

The line to Ogdensburg is now completed, and the branch to Gouverneur is under construction. On the run to Ogdensburg the transmission line is made up of two three-phase circuits on the same line of poles. Each circuit has three aluminum conductors formed individually of seven strands of No. 8 B. & S. gauge wire.

The cables are mounted on Locke porcelain insulators, each of which has three petticoats, is 5⅛ in. high, and has a maximum diameter of 5.75 inches. From the plane of the highest to that of the lowest petticoat the distance is 2.5 in., and the diameter of this lowest petticoat is 2.75 inches. These insulators are mounted on locust pins of 1 7-16 in. diameter in the shank, that have been boiled in paraffin.

Cedar poles with not less than 8-in. tops and 12-in. butts are

FIG. 9.—VIEW ALONG THE CANAL.

used for the 20,000-volt line. Each pole carries two crossarms set with centers 23 in. apart, the upper arm having its center 10 in. from the top of the pole. Each arm measures 8 ft. by 3¾ by 4¾ in., and is secured to its pole by a 12-in. by ⅝-in. through bolt with a 2¼ by 2¼ washer at each end. The lower of the two arms on each pole is braced with a pair of steel L

sections each 1½ in. by 1 in. by 3-16 in., and 3 ft. long. These two braces are secured to the crossarm at points 2 ft. each side of its center by ½-in. carriage bolts, and to the pole by a single lag bolt 2 ft. below the center of the arm.

At the ends of the crossarms, on each side of the pole, there is a vertical brace of 1¼-in. by ¼-in. iron 28 in. long secured to them by ½-in. carriage bolts. Before they are put in position all of the braces are dipped in tar. On the top of each pole a ⅜ by 5-in. lag screw enters the wood in a nearly vertical direction, and beneath the head of this screw a No. 6 B. & S. gauge galvanized iron wire is secured. This wire runs down the pole a few feet and is then connected to a No. 12 copper wire that runs to the bottom of the pole and is there formed into a grounding coil of five turns.

From the electric generating station at Hannawa Falls to the sub-station in the village of Potsdam, a distance of 4.5 miles, there are two circuits of aluminum cables, each cable consisting of seven No. 10 B. & S. gauge wires. These circuits are designed to deliver 375 kilowatts at 4,000 volts in the Potsdam sub-station, when the voltage at the generating plant is 4,400, which is supplied direct by the alternators there. Electric lamp and motor supply in Potsdam is carried out with the energy thus transmitted from Hannawa Falls at 4,400 volts, after the pressure has been lowered by stationary transformers at the former place.

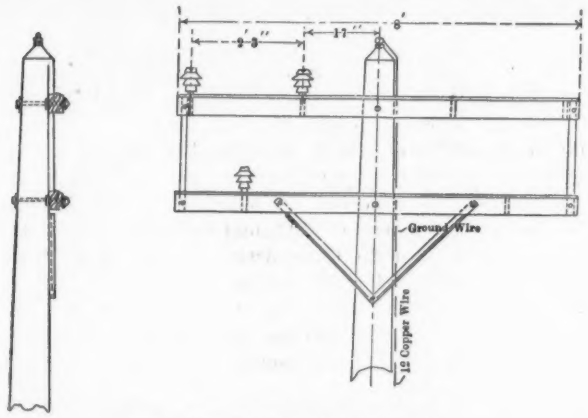


FIG. 10.—DETAILS OF POLE TOP.

On reaching Ogdensburg the 20,000-volt transmission line remains on poles until it reaches the generating station of the Ogdensburg Power and Light Co. and the Ogdensburg Street Railway Co. This station is located at the corner of Lake and River streets near the Oswegatchie River, at about one-quarter of a mile from the center of the business district. This station is a one-story stone building, 77 by 75 ft. on the ground. In this station there are three rooms, one for the steam engine and electric generators, one for the boilers, and one for the 20,000-volt transformers.

Concrete has been used to give the transformer room a fireproof floor. On entering this transformer room the two 20,000-volt circuits are connected with lightning arresters, and then pass to the oil switches and transformers. These latter are in two groups, one consisting of three 100-kw units, and the other group of two 150-kw transformers, all of the Westinghouse make. In the three 100-kw transformers the electromotive force is lowered to about 360 volts for delivery to a 300-kw rotary converter that supplies the railway feeders. By the two 150-kw units the three-phase current of the transmission line is transformed to 2,000-volt, two-phase current, for distribution to lamps and stationary motors.

In the engine room there is one horizontal tandem-compound steam engine, a long main shaft direct coupled to a 200-kw, 550-volt, direct-current generator, and belted to a 2,000-volt, two-phase, 60-cycle alternator of the came capacity, two 75-kw dynamos and a 300-kw, 550-volt rotary converter. From the engine shaft to the main shaft there is a belt connection, and a like connection to the two 75-kw dynamos. Connected to the long main shaft are four 100-hp turbine wheels. A canal from the Oswegatchie River supplies water at a head of 11 ft. for these turbines.

By means of the connections and belting just named, the four water wheels may drive the 200-kw generator for the railway load, and the 200-kw, two-phase alternator for general lighting and power purposes. With the belt from the engine shaft to the main shaft, both of the 200-kw generators just named, as well as the two 75-kw dynamos, may be operated with steam power. The 300-kw, 550-volt rotary is necessary only when energy from the transmission line is being used for the railway.

In addition to the foregoing apparatus, the engine room contains two tub transformers, each of which is designed to supply 6.6 amperes to 85 lamps, and the switchboard. Steam for the engine is produced by a pair of 250-hp boilers, in a room 57 by 59 ft. and separated from the engine room by a stone partition.

The general plan of operation is to carry as much as possible of the load with the four turbine wheels that use the water of the Oswegatchie River. Additional power is, as a rule, drawn from the transmission line, but at certain times, or when necessary, the 600-hp engine is operated. Steam coal brought by water costs $3.50 per ton in Ogdensburg, and it is delivered to the boiler room of the electric plant by carts.

The electric supply load of the station just described is used for 140 alternating-current, 6.6-amp. enclosed arc lamps, 8,000 16-cp incandescent lamps and 60 hp in induction motors. The 60 hp of motor capacity was the amount connected to the 2,000-volt, two-phase lines before the introduction of the transmitted energy from Hannawa Falls at Ogdensburg, and from plans then under way it is probable that the present stationary motor load there is much larger. Among the possible motor loads for the Ogdensburg system to take up is that of 250 hp at the elevator and conveyor of the Rutland railroad docks. To this figure may be added some 350 hp in flour mills, and another 200 hp in smaller industrial plants.

In addition to the above electric supply load, the station named operate the entire street railway system at Ogdensburg, which includes ten miles of single track and not less than fifteen motor cars and a sweeper, besides two cars without motors. The gauge of track is 4 ft. 8½ in., the rails are of 48 and 52 pounds per yard, and the length of paved street covered is not more than 1,000 ft. The line has a maximum grade of 6 per cent., and it crosses three iron bridges with an aggregate length of 174 ft. Motor cars vary from 18 to 22 ft. in length, and each is of the single-truck type with 6.5 ft. wheel base. The motors are 12-A Westinghouse. Closed cars have electric heaters. No connection exists between the street railway tracks and those of any steam road, and the street railway carries mail but no express or freight.

During the year ending June 30, 1904, the gross earnings of this road were $27,862.15. In the same year the expense of fuel for power was $287.25, which seems to indicate that most of the work was done with the local water power.

All of the new electric work at Ogdensburg has been done under the supervision of Mr. Edward F. Hawkins, manager and electrical engineer of the Ogdensburg Light & Power Co., and of the Ogdensburg Street Railway Co.

Plans for all of the hydraulic and electric developments about Hannawa Falls, and for the transmission lines to Ogdensburg and other points were from the office of Mr. Wallace C. Johnson, of Niagara Falls, consulting engineer for the Hannawa Falls Water Power Co., and the work was carried on under his general supervision. Mr. Wm. B. Cogswell, of Syracuse, a director of the Water Power Co., has given the electric development of Hannawa Falls a large share of attention. To Mr. O. H. Tappan, secretary and treasurer of the Water Power Co., more perhaps than to any other man, is due the present success of the Hannawa Falls plant. Mr. Tappan has watched over both the financial and technical details of the enterprise, and his aim has been to sell wood pulp and electric energy, rather than stocks and bonds.

The office of the Hannawa Falls Water Power Co. is at Potsdam, N. Y.

Method of Design for Magnet Windings.

BY F. ALBERT WILLARD.

IN the design of magnet windings there are two principal classes or styles of winding which should be first considered in drawing up a method of design which shall be general and applicable to all.

By reference to Figs. 1 and 2, the points of difference between the two different classes are seen. Fig. 1 illustrates the type of coil which is embedded in metal and will depend on the metal to carry away its heat. In this style of winding the size of slot and the ampere-turns are generally known, and it becomes necessary to design a winding having the required number of ampere-turns that will exactly fill the winding space or slot. The

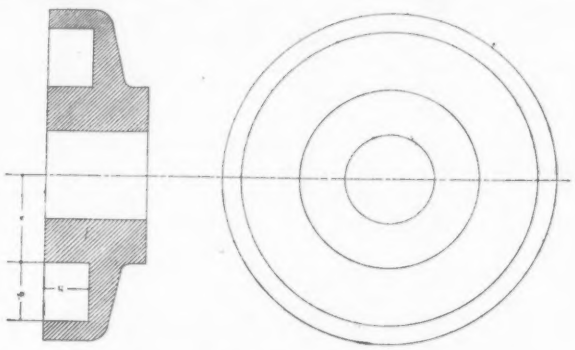


FIG. 1.—PART SECTION AND PLAN OF METAL-EMBEDDED COIL.

heating which this coil will stand continuously is approximately .7 of a watt per square inch of radiating surface, which is the three sides of the coil surrounded by metal. This heating will vary to some extent, depending on the amount of metal adjacent to the winding. In referring to this winding in the future it will be called the "iron clad" type.

Fig. 2 illustrates the most common type of winding, which is known as the "open type," and depends on the three surfaces exposed to the air to radiate its heat. The heating allowable on this type of coil should not exceed .45 watt per square inch of radiating surface. As a general thing the winding space for this type of coil is not limited, and the conditions of design will balance between the cost of copper, depending on the size of wire

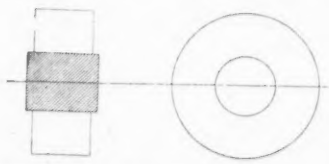


FIG. 2.—DIAGRAM OF OPEN-TYPE WINDING.

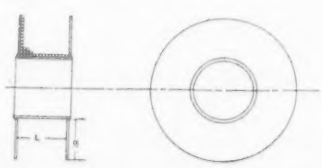


FIG. 3.—DIAGRAM OF LAYER WINDING.

used and the watts lost. In case the winding space is limited we must assume a maximum allowable loss in watts per square inch and proceed with the design, letting the size wire come what it will.

Before we proceed to the design of a winding there is one more point that should be considered, namely, the relation between the cross-section of copper in a winding and the cross-section of the winding outside of the insulation. Giving to this ratio the term "activity," we have

$$Activity = \frac{total\ cross\text{-}section\ of\ copper}{total\ cross\text{-}section\ of\ winding\ space}.$$

This quantity will change with every size of wire, and to avoid trouble should not be lost sight of. In Fig. 4 the curve gives the activity of each size wire for the haphazard winding generally used on all open type coils for wire smaller than No. 18; above this a layer winding is used.

The layer winding is generally used on iron-clad coils in order to economize space. The space factor for this style of winding should be figured according to Fig. 3 as follows:

D = depth of winding in inches.
L = length " "
d = diameter of wire used in inches (over insulation).
N = total number of turns.
S = section of wire in square inches.

$$Activity = \frac{S\,N}{D\,L} \text{ (for haphazard winding).}$$

$$N = \frac{D\,L}{d^2} \text{ (for layer winding).}$$

By using the layer winding, the winding space will come a little larger than is actually needed for the wire alone; since this surplus space is used for insulation outside of the coil, it will be found that the finished dimensions will run very close to the calculated results.

As an example of the design of a winding, assume an iron-clad magnet having 2,300 amp.-turns and which is to operate on a 220-volt circuit. Referring to Fig. 1, let $L = 1.5$ in.; $D = 2$ in.; $r = 3$ in.

The area of the coil radiating surface will be $= 2\pi rL + 2\pi (r + D)\ L + \pi (2r + D)\ D = 125.7$ sq. in.

Ampere-turns $= IN = 2{,}300$.

Mean length of a turn in feet $= M.l.t. = \frac{\pi (2r+D)}{12} = 2.095$ ft.

Resistance of wire in ohms per 1,000 ft. $= \frac{1{,}000 \times E}{I\,N \times M.l.t.} = 45.6.$

By referring to the accompanying copper wire table, it will be

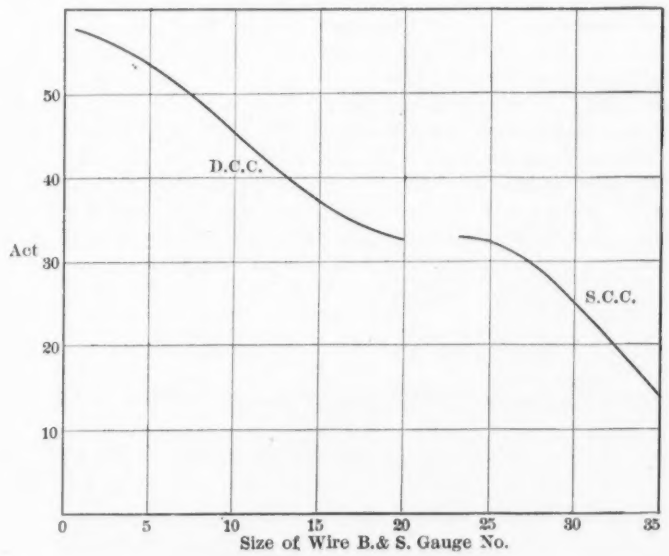


FIG. 4.—ACTIVITY CURVE.

found that under ohms per 1,000 ft. at 65° C. the nearest standard size is a wire having a resistance of 48.3 ohms per 1,000 ft.

$$\text{Number of turns} = N = \frac{L\,D}{d^2} = \frac{2 \times 1.5}{.024 \times .024} = 5{,}200.$$

$$\text{Ohms resistance} = R = \frac{N \times M.l.t. \times 48.3}{1{,}000} = \frac{5{,}200 \times 2.095 \times 48.3}{1{,}000} = 528.$$

$$\text{Current} = I = \frac{W}{E} = \frac{E}{R} = \frac{220}{525} = .42 \text{ ampere.}$$

Total watts lost $= W = I^2R = 92.5$.

$$\text{Watts lost per sq. in.} = \frac{92.5}{125.7} = .735.$$

Available winding area $= L \times D = 3$ sq. in.

Winding area necessary $= N \times d^2 = 3$ sq. in.

The change in size of wire will necessitate an increase in the total resistance of the coil, and consequently will reduce the ampere-turns from 2,300 to 2,183, a decrease of 5 per cent. The object in making this change was to get a winding that would have but one size of wire. Where a change in the number of ampere-turns is objectionable and the calculations show that the proper size comes between two standard sizes, it will be necessary to design a winding using two sizes of wire. This may be done as follows:

Taking for example the above coil, the calculations show that the proper wire is one having a resistance of 45.6 ohms per 1,000 ft. By reference to the wire table it will be seen that this calls for a wire having a resistance between 48.3 and 38.1 ohms per 1,000 ft., and the number of turns for each size of wire will be inversely proportional to the difference between the required resistance and that of the adjacent sizes. For example:

$$48.2 - 45.6 = 2.7$$
$$45.6 - 38.1 = 7.5$$
$$2.7 + 7.5 = 10.2$$

Number of turns of 48.3-ohm wire equals

$$\frac{7.5}{10.2} \times 5{,}200 = 3{,}820.$$

Number of turns of 38.1-ohm wire equals

$$\frac{2.7}{10.2} \times 5{,}200 = 1{,}380.$$

In making up a coil which has two sizes of wire in its winding it is customary to place the large wire at the bottom. This is done for two reasons: First, the coil will build up better and easier, and, second, the small wire coil, having a higher resistance, has a greater loss, and being nearer the surface allows the heat to escape much more readily.

The depth of the wire in the slot $= D = 2$ in.; $r = 3$ in.

In order to determine the resistance of the two-wire coil it will first be necessary to find a mean length of turn for each size of wire. To do this we must have the depth of winding for each size wire, which can be found as follows:

Depth for the 38.1-ohm wire:

$$\frac{2.7}{10.2} \times 2 = .53.$$

$$M.l.t. = \frac{\pi\,(2r + .53)}{12} = 1.71 \text{ ft.}$$

Number of turns = 1,380.

$$\text{Resistance} = R_1 = \frac{1{,}380 \times 1.71 \times 38.1}{1{,}000} = 90.$$

Depth for 48.3-ohm wire equals

$$\frac{7.5}{10.2} \times 2 = 1.47 \text{ in.}$$

$$M.l.t. = \frac{\pi\,(2r + .53) + 1.47}{12} = 2.23 \text{ ft.}$$

Number of turns = 3,820.

$$\text{Resistance} = R_2 = \frac{3{,}820 \times 2.23 \times 48.3}{1{,}000} = 412.$$

Total resistance $= R = 412 + 90 = 502$.

$$\text{Amperes} = \frac{E}{R} = \frac{220}{502} = .438.$$

Ampere-turns $= .438 \times 5{,}200 = 2{,}280$.

This winding brings the coil within one per cent of the required number of ampere-turns and is close enough for all practical purposes.

The methods outlined may be used in the design of any winding, and if followed closely will give accurate results.

In the activity curve of Fig. 4 the flat section in the center of the curve arises from changing the insulation on the wire from double cotton-covered to single cotton-covered. This curve should always be used in determining the activity of wire for haphazard windings.

Wherever it is necessary to wind up a number of these coils it would be a very good plan to make up a schedule as given below, to be used as a record and reference; or better still to have it printed on cards and to keep a card index.

Diam. Mils. Bare	AREA CROSS SECTION		DIAMETER OVER INSULATION				PER 1000 FEET		
	CIRCULAR MILS.	SQUARE MILS.	SINGLE-COTTON	DOUBLE-COTTON	TRIPLE-COTTON	ENAMEL	POUNDS BARE	OHMS. 25°	OHMS. 65°
460	212000	166000					641	.0508	.0584
410	168000	132000					509	.0638	.0735
365	133000	105000					404	.0800	.0925
325	106000	83500		889	848		320	.101	.117
289	83500	65600		808	807		253	.127	.147
258	66300	52300		272	276		208	.160	.185
229	52800	41500		262	267		159	.201	.231
220	48400	38000		238	224		147	.220	.254
204	41600	32700	211	210	220		126	.256	.297
192	37250	29200	200	205	209		113	.284	.332
182	33100	26000	190	194	198		100	.321	.378
172	29600	23200	179	184	188		89.5	.358	.419
162	26200	20600	169	174	178		79.5	.406	.472
153	23400	18350	160	165	169		70.5	.454	.529
144	20700	16300	151	156	160		62.5	.514	.596
134	18000	14100	141	146	150		54.5	.588	.685
129	16600	13100	136	141	145		50.4	.640	.748
120	14400	11300	127	132	136		43.6	.739	.858
114	13000	10200	121	126	130		39.4	.819	.951
108	11900	9350	115	119	123		36	.895	1.04
102	10400	8160	108	112	116		31.4	1.02	1.19
95	9020	7100	101	105	109		27.4	1.16	1.37
91	8280	6500	97	101	105		25.1	1.29	1.49
86	7400	5800	93	96	100		22.4	1.48	1.67
81	6560	5160	87	91	95		19.9	1.62	1.88
78	6175	4850	84	88	92		18.7	1.74	2.02
75	5580	4390	75	82	86		15.7	2.05	2.38
69	4825	3830	76	79	83		14.5	2.30	2.68
64	4100	3220	70	74	78		12.4	2.80	3.01
61	3720	2920	67	71	76		11.2	2.95	3.42
57	3250	2540	63	67	71		9.81	3.25	3.80
54	2915	2290	60	64	68	56	8.85	3.55	4.24
51	2600	2040	56	59	63	52.7	7.88	4.09	4.74
48	2400	1880	54	57	61	50.7	7.27	4.42	5.15
45	2082	1630	50	53	57	46.7	6.14	5.08	6.10
42	1760	1380	47	50	54	43.5	5.35	6.04	7.01
40	1600	1260	44	47	51	41.5	4.86	6.65	7.72
38	1445	1130	42	45	49	39.5	4.38	7.38	8.57
36	1288	1008	40	43	47	36.4	3.71	8.87	10.1
32	1020	798	36	40	44	33.35	3.10	10.4	12.1
30	900	705	34	38	42	31.35	2.72	11.8	13.75
28.5	812	635	32.5	36.5	40.5	29.8	2.46	13.1	15.2
28.5	650	511	29.5	33.5	37.5	26.75	1.97	16.4	19.0
28	629	494	27	31	35	24.3	1.86	16.1	23.3
20	400	314	24	28	32	21.15	1.21	28.4	30.9
18	324	254	22	26		19.1	.982	32.9	38.1
16	256	201	20	24		17.05	.778	41.5	48.4
14	196	154	18	22		15.	.594	54.2	62
12.5	159	125	16.5	20.5			.482	67	77.7
11	121	95	15	19			.367	88	102
10	100	78.5	14	18			.302	106	123
9	81	63.7	13	17			.245	131	152
8	64	50.3	12	16			.194	166	192
7	49	38.5	11	15			.149	217	252
6.5	39.7	31.2	10.5	14.5			.120	269	311
6.0	31.4	24.7	9.5	13.5			.095	339	393
5	25.	19.6	8.5	12.			.076	426	494

CALCULATION OF WINDING.

Sheet No. —. Specification No. —.

Coil area $= A$ ..... sq. in.

Ampere-turns $= IN =$ .....

Mean length of turn $= M.l.t. =$ .....

$$\text{Size of wire} = \frac{E}{IN \times M.l.t.} = \text{.....} \text{ (ohms per foot.)}$$

Turns $= N =$ .....

Length of winding in feet = ...

$$\text{Resistance} = \frac{E}{I} = \text{.....}$$

$$\text{Current} = \frac{W}{E} = I = \text{.....}$$

Total watts radiated $= W =$ .....

Heating allowable (watts per sq. in.) = ...

Gauge.	Res.	Ratio.	Turns.	M.l.t.	Feet.	Res.	Wt.

Available winding area = ...

$$\text{Winding area necessary} = \frac{N \times \textit{sect. sq. mils}}{\textit{Activity}} = \text{.....}$$

Graphic Representation of Induction Motor Phenomena.

By A. S. M'Allister.

As is well known, the simplest method which has yet been devised for representing the electrical characteristics of the induction motor is the one involving the use of the so-called circle diagram of the primary and secondary currents. It is equally well known that the diagram as ordinarily constructed gives results which, although sufficiently exact for most practical requirements, are only approximately correct. Numerous modifications of the simple circle diagram have been proposed from time to time in order to render the representation more nearly in accord with facts. Most of the modifications are based on the assumption that the primary current locus would be a true circle if the primary resistance could be neglected, and they include some approximate proof as to the modified location of the center of the circle when the primary resistance is taken into consideration. The treatment below is intended to show that the primary current cannot be accurately represented by any circle howsoever located, even if the primary resistance were negligible, but that in any event the secondary current locus is a true circle.

Although in the secondary circuit the frequency varies directly with the slip, and, therefore, for constant coefficient of self-induction, the secondary reactance varies in direct proportion with the slip, and in general the secondary resistance is more or less constant, it is convenient and helpful to treat the machine as a stationary transformer in which the secondary reactance is constant and the resistance varies with the load. That is to say, the performance of the secondary of the motor will be faithfully represented if all the power received from the primary be considered as dissipated in resistance in the secondary circuit, the slip at all times being taken as unity, and the total secondary resistance (conductance) being assumed to be varied according to the secondary load, or, briefly, the induction motor may be treated in all respects like a stationary transformer. The effect upon the transformer quantities of increasing the speed from zero to synchronism is the same in all respects as increasing the external resistance in the secondary circuit from zero to infinite value, the output from the motor being represented in any case as the power lost in the fictitious external resistance.

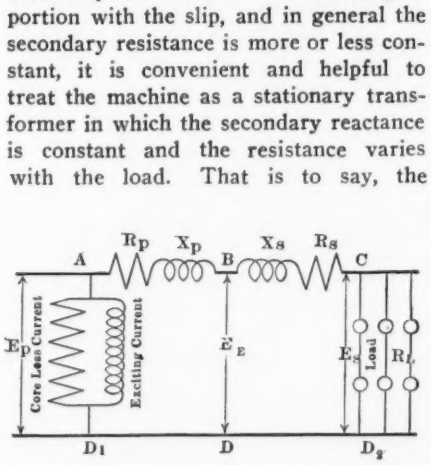


FIG. 1.—PRACTICALLY EXACT REPRESENTATION OF CIRCUITS OF AN INDUCTION MOTOR.

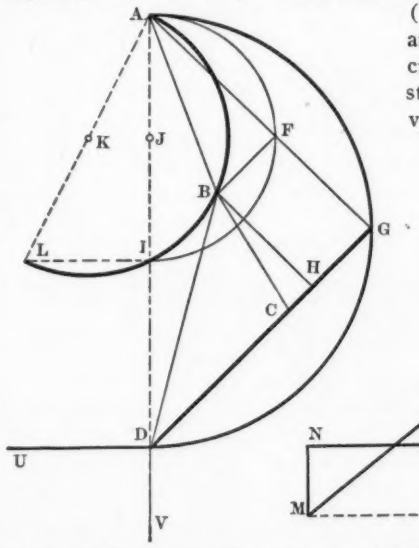


FIG. 2.—CIRCLE DIAGRAMS OF ELECTROMOTIVE FORCES OF AN INDUCTION MOTOR.

Fig. 4 shows the conventional method of representing the electric circuits of a transformer which has an equal number of turns in the primary and secondary windings. This diagram is based on the assumptions that the reluctance of the core is constant for all densities of magnetisms and that the iron losses vary with the square of the magnetic density in the core. It is obvious that neither of these assumptions is absolutely correct with reference to any commercial stationary transformer, but it is true that the errors involved in any calculations depending upon these assumptions are practically negligible. It is evident that in an induction motor the reluctance of the total magnetic path is much more nearly constant than that in an induction motor, and that if the frictional and windage losses be included with the iron losses, the circuits shown in Fig. 4 will serve admirably for all calculations connected with this machine.

In the diagram of Fig. 4 Rp and Xp are the primary resistance and local leakage reactance, while Rs and Xs are the secondary resistance and local leakage reactance, respectively.

An examination of Fig. 4 will show that the primary current is made up of three components: the quadrature exciting current, the core loss current and the load current, of which it is the vector sum. Under operating conditions the current which flows through the primary coil causes a drop in voltage across the local primary impedance and hence the internal counter e.m.f. decreases with increase of load, and there is a decrease in both the exciting current and the core loss current. If it be assumed initially that the variation in the values of these currents is negligible in comparison to the load current of the machine, the treatment becomes much simplified and yet the true conditions are fairly well represented.

Fig. 1 shows the circuits as they could be represented on the basis of the latter assumptions. The current taken by each of the three circuits will flow independently of the currents in the other two circuits, while the total measurable primary current will be the vector sum of the three components. Only one of the component currents varies with the change in load, and its value can easily be determined when the resistance of the load circuit is known. It will be noted that the load circuit contains a constant reactance $(Xp + Xs)$ in series with a variable resistance $(Rp + Rs + Rt)$, where Rt is the fictitious resistance of the load. It will be seen, therefore, that the current which flows through this circuit under a constant impressed e.m.f., E, can be represented by a vector whose extremity describes the arc of a circle having a diameter equal to $E \div (Xp + Xs)$.

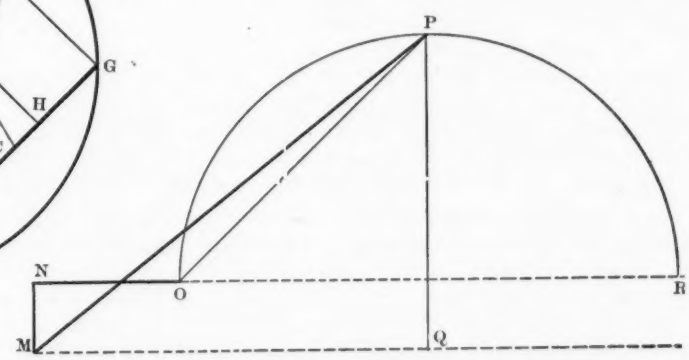


FIG. 3.—PRACTICALLY EXACT PRIMARY AND SECONDARY CURRENT LOCUS.

The arc $O\,P\,R$ of Fig. 3 indicates a section of such a secondary current locus. At any point, P, on this arc, $O\,P$ represents the secondary current both in value and phase position. The quadrature exciting current is represented by $O\,N$, while $N\,M$ shows the core loss current (to supply all of the no-load losses). The vector sum of these three currents, $M\,P$, in Fig. 3, is the primary current, while the angle of lag of the current behind the circuit e.m.f. is shown by $N\,M\,P$, the cosine of which is the power factor. The power component of the primary current is indicated by the line, $P\,Q$, and the product of this with the circuit e.m.f. gives the input to the motor.

By means of this simple circle diagram, the construction of which is based on somewhat erroneous assumptions, the complete performance of the motor may be determined with a degree of accuracy which seldom need be exceeded for any purpose of designing or testing, since the errors introduced are of small moment, and are not misleading; moreover, they tend to disappear in the final composite results. Thus the input to the secondary at any chosen current may be found as the difference between the primary input and the sum of the primary losses, which latter include the easily calculated copper loss and the approximated "constant" losses. The secondary input is at once the torque in "synchronous watts"; the ratio of the secondary copper loss to the secondary input is the slip, while the output is the secondary input minus the secondary copper loss. It is possible also to rep-

resent the various quantities graphically by simple circular arcs and straight lines.

In comparing Fig. 1, on which the simple circle diagram of Fig. 3 is based, with Fig. 4, on which a true diagram should be based, it will be observed that the errors involved relate merely to the quadrature exciting current circuit and the core loss current circuit; the voltage across these circuits is not constant, but it varies with the load current. Since that portion of the drop of voltage across the primary impedance, which is due solely to the core loss current and the exciting current, is quite negligible in comparison to that due to the load current, it is permissible to assume that the voltage at *B D* in Fig. 4 depends entirely upon the load current. This assumption is equivalent to neglecting terms of higher order. These may be taken into consideration graphically without difficulty, but the gain by so doing is not sufficient to justify the added complications.

The internal voltage diagram of an induction motor is represented in Fig. 2, where *A D* is the impressed primary e.m.f., *A F* is the drop through the primary reactance, *B F* is the drop through the primary resistance, and, hence, *A B* is the primary impedance drop. The secondary reactance drop is *B H*, *C H* is the secondary resistance drop, and *B C* is the secondary impedance drop. *C D* is the voltage consumed in the fictitious external load resistance, and, hence, is the secondary e.m.f.; *Es* in Fig. 1 or Fig. 4. The line *B D* in Fig. 2 is the e.m.f.,

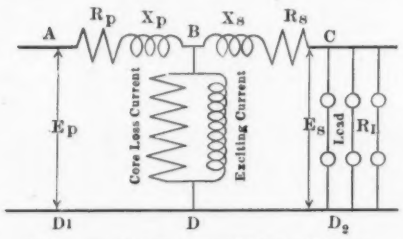


FIG. 4.—EXACT REPRESENTATION OF CIRCUITS OF AN INDUCTION MOTOR.

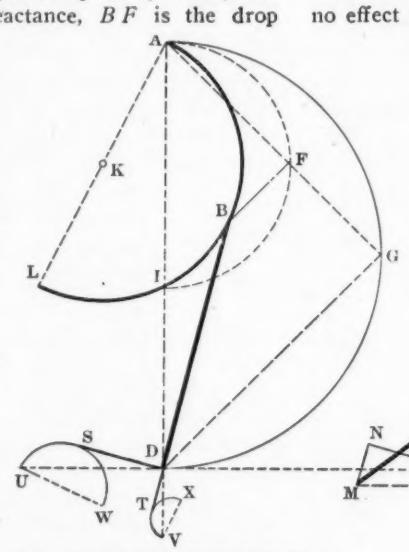


FIG. 5.—CIRCLE DIAGRAMS OF ELECTROMOTIVE FORCES AND CURRENTS.

Ee in Fig. 1 or the voltage across *B D* in Fig. 4.

The current in the secondary is in phase with *G D*, and in quadrature with *A G*. The angle, *A G D*, is a right angle, so that the point, *G*, describes a circle with its center on the line, *A D*. The point, *F*, describes a circle, *A F I*, with its center at point, J, on line, *A I D*. The distance, *A I*, bears to the distance, *A D*, the ratio of the primary leakage reactance to the total leakage reactance of the machine. The point, *B*, describes a circle, *A B I L*, having its center, *K*, on the line, *A L*. The angle, *T A L*, has a tangent equal to the ratio of the primary resistance to the primary leakage reactance.

It will be noted from Fig. 4 that the three component currents may be determined at once when the secondary load current is known and the voltage across *B D* has been found. Referring now to Fig. 5, and remembering that the core loss current is in phase with *B D* and proportional to it, it will be seen that this current can be represented by the line, *D T*, where *T* describes a circle having its center on the line, *V X*, the angle, *D V X*, being equal to the angle *I A L*. Similarly, the exciting current, which is in quadrature with *B D*, can be represented by the line, *D S*, where S describes a circle having its center on the line, *U W*, the angle, *D U W*, being equal to the angle, *I A L*. *D U* and *D V*, of Fig. 5, are respectively equal to *D U* and *D V* of Fig. 2, or to *O N* and *N M* of Fig. 3.

The corrected current locus of the induction motor is shown in Fig. 6, where the arc, *O P R*, is in all respects the same as the semicircle, *O P R*, in Fig. 3. The line *O P* in Fig. 6 is parallel to the line, *D G*, in Fig. 5, but it varies in length directly with the line, *A G*, of Fig. 5. *N M* of Fig. 6 is equal to *D T*, and is parallel and proportional to *B D* of Fig. 5. *O N* is equal to *D S*, is in quadrature to and proportional to *B D* of Fig. 5. The primary current is represented by the line, *M P*, as the vector sum of *O P*, *O N* and *N M*, that is as the resultant of the load current, the quadrature exciting current and the core loss current.

In Fig. 6 the line *P Q* is the proper component of the primary current, the product of which with the impressed e.m.f. gives the input to the motor. The complete performance of the machine can be determined in a manner exactly similar to that outlined for the simple circular locus of Fig. 3.

The current locus in Fig. 6 is based primarily on the transformer features of the induction motor, and it is inexact only to the extent to which the motor differs from a transformer in its electrical behavior. The frictional loss is treated as a core loss, and hence it is tacitly assumed that this loss necessitates a power component of current in only the primary winding. This treatment involves no error with reference to the primary current, but it neglects a certain component of secondary current, which, however, is too small to need consideration.

It will be noted from Fig. 2, that the secondary resistance has no effect whatsoever on either the current locus shown in Fig. 3 or that shown in Fig. 6. The primary resistance has no effect on the secondary current, although the primary current depends somewhat on this resistance. If the primary resistance were negligible, the point *B* in Fig. 5 would follow the circular arc,

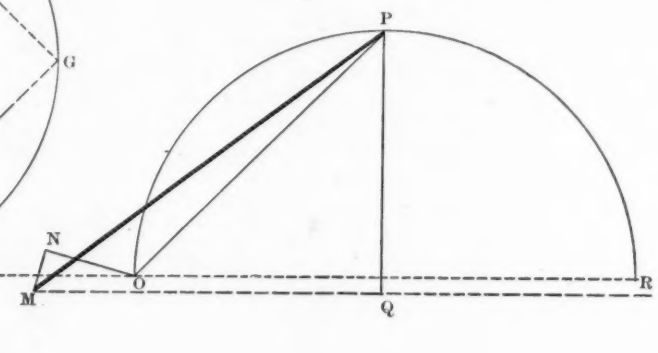


FIG. 6.—CORRECTED CURRENT LOCUS OF AN INDUCTION MOTOR.

A F I, and both the angle, *D U W*, and the angle, *D V X*, would reduce to zero; the general form of the locus of Fig. 6 would be changed only slightly.

Worcester Polytechnic Institute.

Brief mention was recently made in these columns of the decision of the trustees of the Worcester Polytechnic Institute to erect a new building for the use of the Department of Electrical Engineering. As the plans for the building are nearing completion, it may be well to mention some of the features.

The building will be of the general shape of a quarter-inverted block letter— ⌐ —a main portion, some two hundred feet in length and seventy feet in width, containing the principal laboratories, and a wing at each end about fifty-five feet square containing lecture rooms, design rooms, class rooms and special laboratories, the entrance forming the projection between the two wings.

The feature of the building which will strike the visitor most particularly at first sight will be the large general laboratory, with a ground floor space of fifty-five by two hundred feet. Galleries, fourteen feet in width will extend down each side of this room, leaving a space down the center, twenty-six feet wide, extending to the roof, forty-five feet above. An electric traveling crane will serve this central portion, while the galleries and the ground floor space under them will be served by I-beam trolley travelers. The heavier apparatus will be located in the central portion of the room, while experiments involving lighter apparatus will be assigned to the gallery spaces. Arrangements will be made to transfer loads from the traveling cranes to the trolley travelers serving the galleries.

No part of this building will be devoted to primary power generation, as the Institute has available an ample supply of two-phase alternating current from its service power plant which is located in a separate building. Current will be brought into the laboratory from the power plant through underground conduits, at 2,200 volts, to the switchboard and step down transformers, located under the gallery at one side of, and about midway of the general laboratory. This switchboard will control, in addition to the supply circuits, all of the distribution and transformation of the power for the entire laboratory.

For transformation of the current for various experimental purposes, there will be a 200-kw double-current generator, driven by an induction motor, and supplying 500-volt direct-current and 25 cycle alternating current for the railway laboratory; a smaller 500-volt motor-driven generator; two 60-cycle motor-driven alternating-current generators; two 110-volt rotary converters; two 110-volt motor-driven generators; besides the large number of smaller generators and motors which now form the already fine equipment of the Institute's electrical laboratory.

A notable feature will be the electric railway engineering laboratory, a part of the equipment for which will be a twenty-five ton double-truck four-motor electric car, the exterior of which will closely resemble an ordinary interurban car; but instead of seating capacity, the interior will be occupied by automatic recording instruments for the purpose of indicating not only the performance of the car in operation, but also the electrical and physical conditions of the track and electrical circuits over which it is operated. Double doors at one end of the building and two tracks connecting with the local electric railway system will afford an entrance for this or other cars into the laboratory. Inside the building, one of these tracks will be over a pit for inspection and repair purposes, while the other will terminate in a testing stand, arranged for the reception of the Institute car or any other car. While on the testing stand, the car will rest on supporting wheels, which, as they revolve, will give the effect of a moving track, the car being held in a stationary position. Suitable arrangements have been designed for applying a load to the supporting wheels in such a way as to perfectly imitate the losses in rolling friction, wind resistance, etc., as well as the acceleration and retardation momentum of the equipment under test. The power consumed by the car during any given run will be measured by the power input, and by the power absorbed in the loading apparatus, as well as by a traction dynamometer, all of the instruments being autographic. A very complete equipment of the various forms of controlling, braking, heating, signalling and other accessory electric railway apparatus will be installed, as well as both alternating and direct-current railway motors for "stand tests." The Institute, the first technical school to establish a department of electric railway engineering, will also be the first to equip a complete laboratory for the study of the subject.

A separate small building, adjacent to the laboratory, will house a special 750,000-volt transformer and a 200,000-volt transformer. Circuits from the transformer house will terminate in the third floor of one of the large wings of the main building, which will be used as a high potentials and insulations laboratory.

The first two floors of this wing will be occupied by a lecture room, seating 300 persons, and provided with ample circuits, switchboard and traveling crane facilities, so that apparatus of any character and current of whatever nature required for its operation may be readily brought from any of the various laboratories.

The opposite wing of the building will be occupied by smaller lecture and recitation rooms, department offices, design rooms and the department library. Provisions are made for a storage battery, instrument room, work-shop, standards laboratory, wash-room and locker-room, all of which will be fully equipped. The building will be heated by an indirect system, the primary heat being steam from the Institute power plant. The lighting of the building has been made the subject of special study, and an endeavor will be made to represent every present commercial form of electric illuminant by applying each to one or more rooms, assigning in each case the form particularly adapted.

Yonkers Electric Light and Power Company.

THE City of Yonkers has a population of about 60,000 people and covers an area of about 18½ square miles. The Yonkers Electric Light & Power Company supplies the city with electric energy which is now being transmitted from the Bronx station of the New York Edison Company and distributed from the old Elm Street station of the Yonkers Electric Light & Power Company. The equipment in this latter station consisting of two 150-kw, 2,200-volt, three-phase, belt-driven generators is held for emergency use or to carry the day load when repairs are being made on the transmission line from New York City.

The equipment in the Bronx station of the New York Edison Company consists of three 300-hp and one 550-hp Stirling water-tube boilers and three 650-hp Babcock and Wilcox boilers which supply steam to the following engine equipment: Two 500-hp Greene engines, one 1,200-hp Greene engine, one 250-hp McIntosh and Seymour engine and one 500-hp Fitchburg engine. In addition there is now being installed a 1500-kw Allis-Chalmers turbo-generator set. The electrical supply consists of 2200-volt, two-phase, 60-cycle currents.

Two high-tension three-phase lines carrying current at a potential of 6600 volts run direct from the Bronx station to the Elm Street station at Yonkers, 12 miles distant. These lines are on a single pole line and come in at Yonkers through General Electric lighting arresters to a high tension panel which is equipped with polyphase watt-hour meters. Two triple-pole double-throw switches connect either line to step-down transformers, and a third switch is arranged to throw both lines in multiple. From the transformers the current passes to a receiving panel which connects the 2200-volt current to the bus-bars. From this point feeder panels provide for power circuits for lamps and motors, the lighting load being carried on single-phase circuits. The load transmitted from the Bronx station is about 750 kilowatts. The company contemplates shortly to change over the system to four-wire two-phase.

The company has a contract with the city to light the streets with 304 6.6-ampere alternating-current series enclosed-arc lamps and 522 25-cp series incandescent lamps. Most of the commercial lighting is by Nernst lamps and incandescent lamps, the total number of the latter connected being 42,220. The first Nernst lamp installed by the company was connected in January, 1903, and one of the most notable instances of its successful employment to win over the shopkeepers of a small city to the cause of electric lighting has been at Yonkers. Gas here sells at $1.00 per thousand cubic feet, but so successful has the electric light company pushed the Nernst lamp, that gas and gasoline arc lamps have almost entirely disappeared. Many shops, although still equipped with ordinary Welsbach mantle gas lamps and gas arc lamps, use the Nernst lamps in preference. The company supplies the Nernst lamp free of charge and looks after its maintenance, with the result that the lighting business has grown enormously. On June 1, 1905, the number of Nernst lamps installed was as follows: 196 one-glower lamps; 382 three-glower lamps, and 13 six-glower lamps, a total of 591 lamps with 1420 glowers. The growth since then may be gauged from the number in use on March 1 of this year, which is as follows: 638 one-glower lamps, 571 three-glower lamps and 10 six-glower lamps, a total of 1219 lamps with 2411 glowers, making an increase of over 100 per cent in the number of lamps connected in nine months.

By an agreement among the storekeepers, shops are kept open on Monday, Tuesday and Wednesday nights until 7 p. m.; on Thursday until 6 p. m.; on Friday until 10 p. m., and on Saturday until 11 p. m.; so that the bill for lighting is not very high. All the Nernst lamps have a special name plate on which is a number and the legend, "Property of the Yonkers Electric Light & Power Company." The lamps are all tested before being installed and when a glower burns out a new one is quickly put in place, this method having been found very satisfactory to customers as it does not leave them in darkness while repairs are being made. The general plan is to inspect lamps on Friday

night so as to have all the lamps in perfect condition for Saturday, on which night most business is transacted. An inspector attends to all troubles reported to the office as well as any he may locate himself. If for any reason he cannot attend to the lamps on a customer's premises, a note is made of this fact and the day repair man who looks after the delivery of incandescent lamps and attends to general complaints, sees that the lamps are put in perfect condition. Any hurry complaints are attended to by any wireman at hand, all wiremen being instructed in the troubles of Nernst lamps and their remedy.

Globes are cleaned only during the day, one man devoting his entire time to going over the district for this purpose and any globes found in improper condition or which are dirty are quickly reported by the night inspector. The night inspector carries a tin case suspended from a strap around his shoulder, containing a supply of one, three and six-glower holders, and also pliers, tweezers, glower-holder extractor and a woolen cloth for handling hot shades, etc. These cases are filled during the day at the station by the man looking after the day repairs and are furnished complete to the night inspector before he makes his rounds. The average life of glowers has been found to be 590 glower hours, although some single glowers have an average life of 1000 hours; but it is the policy of the company to change these glowers at the end of 600 hours' burning so as to avoid the decreased candle-power from the lamp and the attendant dissatisfaction on the part of the customer. The pressure conditions are such that 3.1 watt lamps may be used on the same circuits with an average life of about 575 hours. This life is based on the policy of the company to renew gratis any lamps that have become black or deficient in candle-power.

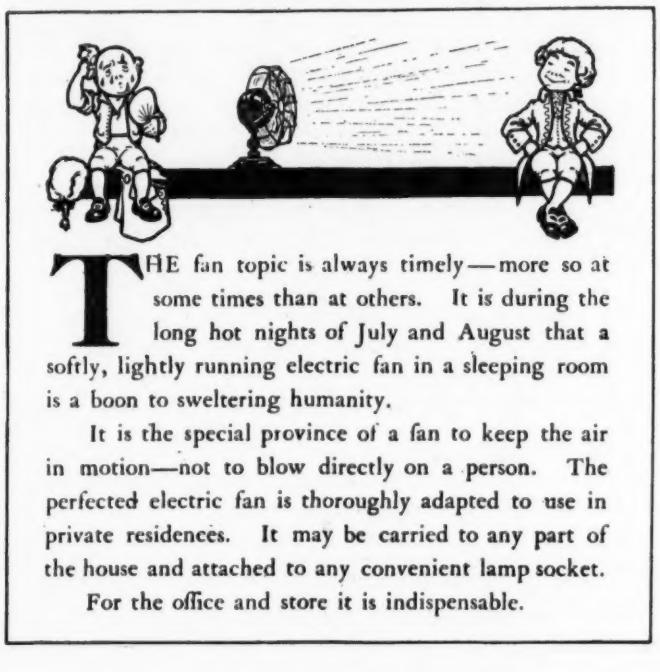
All power is sold by meter, the rate being 15 cents per kilowatt-hour for the first and second hour of burning; 10 cents for the third and fourth hour, and five cents per kw-hour for any lamps burning after four hours. Advertising circulars are sent out to prospective customers, or users of any particular electrical devices. In addition the company sends out regularly a large number of the monthly bulletins of the New York Edison Company marked "Compliments of the Yonkers Electric Light & Power Company." Specific "follow-up letters" on different subjects are also written and mailed at periods varying from 10 days to two weeks or more until some reply is obtained. The attention of the public toward the use of electric light and electric appliances is one of the subjects and also the diffusion of the idea that electric light is a luxury, the price of which is within the reach of all.

The office of the company, which is located at 14 North Broadway, is a well-equipped showroom of electrical appliances and methods of lighting. A feature is not the size of the display, but rather the fact that each sets prominently by itself and is distinctively illustrative of its application. The office walls are decorated with enlarged photographs of various applications of the electric light in the home, office, store and even in church. Electric signs and other electrical devices are also installed.

The company prides itself on the manner of handling complaints. If a claim is made that a bill is excessive, a thorough investigation is made and if no error is found and in the judgment of the company the meter is at fault, a test is made at once and a report sent to the customer. If the test as submitted is not satisfactory to him, the privilege of testing the meter in the presence of a third party is offered to him; the settlement thus aided or obtained being secured on the basis of referendum. A note is made of complaints of service and inspectors are sent to make an immediate investigation. If the fault rests with the lamps these are immediately changed; and if the fault is due to the wiring a suggestion is made to the customer of what would give him better results. The policy of the company is to give prompt attention to complaints and also a fair discussion of them.

The electric sign business in Yonkers has gained some headway and is materially advanced by the very liberal offer of the company; namely, that the sign is made, wired for, and owned by the company. A minimum charge is made of $3.00 per month for all small panel signs, and 75 cents per letter per month for lettered signs. There are about 40 signs in use of various kinds, 30 of which are owned by the company and leased as before stated.

An example of timely advertising literature now being distributed by the company is shown herewith. Another folder is entitled "Timely Suggestions," in which attention is called to the fact that the annual spring cleaning offers a good opportunity to introduce new electric light wires or to extend old ones. The manifold advantages of the electric light and electric fan are dwelt on in this little folder as well as the use of electricity for motors and cooking utensils. The electric sign as a business-getter is also one of the topics, and the company informs its



THE fan topic is always timely—more so at some times than at others. It is during the long hot nights of July and August that a softly, lightly running electric fan in a sleeping room is a boon to sweltering humanity.

It is the special province of a fan to keep the air in motion—not to blow directly on a person. The perfected electric fan is thoroughly adapted to use in private residences. It may be carried to any part of the house and attached to any convenient lamp socket.

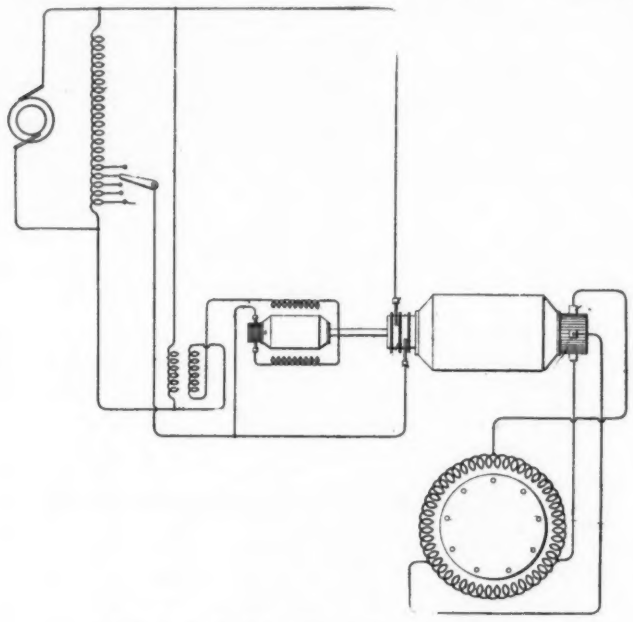
For the office and store it is indispensable.

patrons that it has experts in every line of electrical work who, upon request, are at immediate call. This folder is printed on yellow tinted paper in red and black ink, and across the top of each page is an illustration of four waiters delivering electric lamps on a platter, while under the illustration are the words, "At Your Service." "Where the Breezes Blow" is the title of another timely folder printed on green tinted paper and appropriately illustrated, which is devoted to fan motors. The company reminds its patrons that the fan season will soon begin and that it is time to have last year's fan put in good condition or to buy new fans. All of the advertising literature is attractive in form and shows both thought and taste in the arrangement and wording. The officers of the company are as follows: T. E. Murray, president; J. Williams, secretary; N. F. Brady, treasurer; W. T. Morrison, acting manager, J. P. Radcliffe, Jr., general manager, and W. J. Chisholm, superintendent.

Variable Speed Induction Motor.

The accompanying diagram indicates a system for variable-speed operation of alternating-current motors as disclosed in a **patent issued March 6 to Mr. B. G. Lamme.** The inventor uses a polyphase induction motor and varies the speed by changing the frequency of the current supplied to this machine. The motor receives current from a special frequency changer, which consists of a rotary converter, the field magnets of which are not provided with magnetizing coils, alternating current at a constant frequency being introduced at the collector rings. The rotary is driven at any desired speed by means of an alternating-current series motor. When the rotary is stationary the frequency of the current supplied to the induction motor is equal to that of the main system, while when the rotary runs at syn-

chronous speed the frequency is zero. By means of the circuits shown in the accompanying diagram the voltage impressed upon



LAMME VARIABLE-SPEED INDUCTION MOTOR.

the induction motor varies with the frequency, and hence the core magnetism of the motor is constant.

Maximum Efficiency of a Storage Battery.

BY BENJ. F. BAILEY.

THE following test was conducted in the laboratory of electrical engineering at the University of Michigan by E. M. Gladden and B. A. Baker under the supervision of the writer. The object of the test was to get the highest possible efficiency from a storage battery. It is well known that the efficiency increases as the periods of charge and discharge are made shorter, and in order to make these cycles very short we used a 60-cycle alternating current furnished from the city mains at 110 volts.

As shown in the figure, we passed this current through a rheostat and the primary of a 10-to-1 transformer. From the secondary of the transformer we sent the current through a fuse box to an electrodynamometer by means of which we determined the current and kept it constant at 20 amp. by varying the resistance in the primary circuit. From the electrodynamometer the current passed to the storage battery consisting of two 160-amp.-hour cells, with a normal discharge rate of 20 amp. These were connected in opposition so that they might not discharge through the transformer. We used a double-pole, double-throw switch connected as shown, to facilitate comparisons of the voltage of our test cells and a cell which we used as a standard and left upon open circuit except when taking readings. The differences in voltage were so small that we connected the test cell in opposition to our standard and measured the difference in voltage with a millivoltmeter. This instrument read from 0 to 300 and gave a deflection of about two-thirds the scale.

At the beginning of the test the voltage of the standard cell was 2.074, No. 1 was .0055 volt greater and No. 2 was the same as the standard. All these cells discharged gradually, but the test cells, with the alternating current passing through them, less rapidly than the standard which remained on open circuit. The difference between No. 1 and the standard was practically constant for about 50 hours, during which time No. 1 was probably discharging slightly into No. 2 through the transformer, for at that time No. 2 had gained until it was .0036 volt ahead of the standard. From that time on the e.m.f. of the two test cells fell off at nearly the same rate until, at the end of the test, 128.5 hours after starting, No. 1 was .0068 volt and No. 2 .0050 volt ahead of the standard, whose voltage had dropped to 2.072 volts. The voltage of the standard had been as low as 2.058 volts, but the temperature, which varied between 55° and 65° F., was probably high at the end of the test.

The quantity of electricity passed in the two directions certainly averaged the same. Consequently this test shows that the ampere-hour efficiency of a storage cell when worked with very short cycles of charge and discharge is almost exactly 100 per cent. In fact, the loss of charge is not so great as in a cell standing upon open circuit.

We next investigated the watt efficiency of the cell under the same circumstances. We measured the alternating voltage and watt loss at the terminals of the two test cells, and, using a 20-to-1 multiplier to make the deflections readable, we got no appreciable voltage. The loss at 60 cycles per second was 1.35 watts, giving the high efficiency of 98.1 per cent by the formula:

$$\text{Efficiency} = \frac{\frac{I}{1.11}E - \frac{W}{2}}{\frac{I}{1.11}E}.$$

In which I = total current.
E = e.m.f. of one cell.
1.11 = form factor = ratio of effective current to average current.
W = total watts lost and $\frac{W}{2}$ = loss per cell.

I was 20 amp. and E averaged 2.07 volts.

In getting the watt efficiency we assumed, by using 1.11 as the

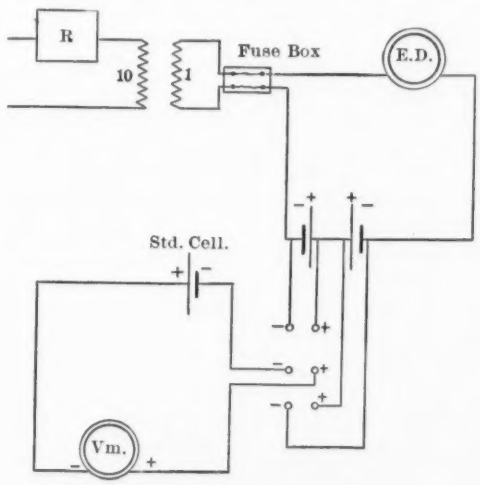


DIAGRAM OF CONNECTIONS.

form factor, that the voltage curve was a sine curve, which is approximately correct, and the difference in efficiency is negligible. The specific gravities of the cells showed greater density for the first 30 hours. Probably the decrease in temperature, also indicated by the drop in voltage of the cells, more than made up for the discharge, and this caused the specific gravity to rise. The average densities were as follows: Cell No. 1, 1.1777; No. 2, 1.1732; standard, 1.1702. The average of all was 1.1737.

On page 113 of Lyndon's "Storage Battery Engineering" the author says: "In passing alternating current of various frequencies through two electrodes immersed in dilute sulphuric acid, . . . at low frequencies, the deposit was brown peroxide, and at high frequencies, white sulphate only was produced, which fell from the plates as fast as formed. In the former case the time of one impulse was long enough to form sulphate and change it into peroxide; in the latter the impulse lasted only long enough to form the sulphate, which was thrown off on the succeeding impulse in the opposite direction."

No deposit of any kind was noticeable in our experiment and the cells showed no injury.

In addition to the long test we ran a short one to show the effect of various frequencies. With the current constant at 20 amp., it was as follows: 10 cycles, 97.4 per cent.; 25 cycles, 97.3 per cent.; 35 cycles, 97.6 per cent.; 60 cycles, 97.8 per cent.; 120 cycles, 97.8 per cent. As was expected, the efficiency increases slightly as the frequency becomes greater. In a storage cell we have at least two losses, an I^2R loss and a polarization loss. Apparently with very short cycles of charge and discharge, the polarization does not have time to manifest itself and we have the I^2R loss only.

Interior Illumination.

At the April meeting of the Illuminating Engineering Society, which was held on April 12, a general discussion was had on the subject of interior illumination, introductory papers being presented by Mr. R. M. Searle, of Mount Vernon, N. Y., and by Mr. Douglass Burnett, of Baltimore, Md. The secretary reported that the membership to date was 390, and it was announced that the next meeting would be held May 11, at which street lighting by incandescent lamps would be the topic of discussion.

The paper by Mr. Searle dealt specifically with the proper use of gas lamps, and pointed out the necessity which exists for teaching the general public to employ the most efficient and effective burners for each class of service. One of the greatest sources of loss is found in the absorption of the light rays by the globes. A portion of the loss may be attributed to the frosting on the globes, but in most installations the major part of the existing loss is caused by the deposit of dirt on the globes, which deposit is usually much greater with frosted than with clear globes. Poor and uneconomical service can often be traced to improper supervision of the lamps, and, in this connection, too much stress cannot be laid on the importance of using good tips. In selecting the locations for the lamps due regard should be had to the possible service which each lamp can render. A slight change in the position of a lamp may cause the light from it to serve more than one purpose, and in installing the lamps utility should not be sacrificed. It is to the advantage of the gas company to encourage the use of portable reading lamps. The author expressed the opinion that each person should work for the common good of illuminating engineering.

The paper by Mr. Burnett pointed out the great importance of securing definite information or rules by which lamps, and particularly electric lamps, should be arranged for obtaining the proper illuminating effect. The illuminating engineer should be well versed as to the characteristics of the various illuminants. The author presented a long list of questions relating to specific lighting problems, in order to invite discussion concerning them. He expressed the opinion that arc lamps are hardly to be considered acceptable for illuminating furniture stores or for general office lighting, and that incandescent lamps are not best suited to department store lighting. It is desirable that some definite agreement be reached with reference to the unit of illumination; that is, whether the unit should be candles or watts per square foot of floor area or cubic foot of room volume, or whether the foot-candle unit should be used. Already some very good results have been obtained by planning the illumination on the basis of from one to two watts per square foot.

Mr. V. R. Lansingh discussed in detail several of the lighting problems mentioned by Mr. Burnett. He stated that the object in illuminating a store window is both to attract attention and to display the goods. All lamps should be hid so that the light does not directly reach the eye of the observer. If border lamps are used they should be well shaded. In regard to the different styles of reflectors, it may be stated that the trough type is not as effective as the cone type, due to the limited area and position of the reflecting surfaces. Store fronts should be illuminated by lamps in the windows and not by arcs outside over the street. For large jewelry stores arc lamps have been found to give excellent service. It is important to eliminate all glare when office lighting is being arranged, and for this purpose the office lamps should be of small candle-power and well distributed. In theatres the illumination should be so designed that no lamps are placed below the balcony or in the line of vision between the spectators and the stage. It is incorrect to assume that only arc lamps are suitable for department stores, because the illumination can be carried out with excellent effect by means of incandescent lamps.

Dr. A. H. Elliott stated that with both gas and electric lighting excessive fatigue of the eye is produced when the illumination is irregular or the light is of improper color. The physiological features of illumination present numerous problems which should receive careful and thorough study. He endorsed the several statements made in Mr. Searle's paper with reference to gas lighting. The extremely small openings in globes at the present time may be attributed to the continued use of antiquated fixtures.

Mr. W. S. Kellogg, speaking from the point of view of the architect, remarked that more trouble arises from the excessive brilliance of the illuminants than from the lack of illumination. It is of prime importance to consider the distribution of the lamps.

Mr. T. J. Lytle, Jr., in continuing the discussion of the disadvantage arising from using concentrated illumination, pointed out that the objection which has been urged against the Welsbach gas mantle on account of the excessive whiteness of the light has been overcome in a recently developed mantle which affords a yellow white light. This latter form of lamp is even more efficient than the glaring white mantle. The most effective illumination is that obtained from tinted-globed lamps used in a room with white ceiling and cream-colored side walls. The inverted gas burner has been found to be quite efficient, and it is especially advantageous for decorative effects. The real problem which confronts the illuminating engineer relates to the proper selection of glassware for the lamps and the color scheme for the rooms.

Mr. J. D. Israel congratulated the Society on the good work it is doing in bringing together the different companies in the lighting business, and expressed the hope that the contractors, architects and manufacturers would all get together for the good of illuminating engineering. The Philadelphia Electric Company maintains a special department whose members devote their whole time to illuminating engineering for the purpose of establishing cordial relations between the company and its customers. Circular letters are sent regularly to the customers and to architects and contractors.

Mr. John Campbell stated that the major portion of the existing bad illumination is due to the misleading statements made by the different sellers of apparatus, and to the prevalent use of rule of thumb methods in deciding upon the number and location of the illuminants.

Mr. W. D'A. Ryan remarked that it is extremely difficult to get people to agree to use less light uniformly distributed. They insist on obtaining an excess of brilliancy. Mr. E. L. Elliott thought that the fixture manufacture should be instructed to build the fixtures to conform to scientifically designed lamps and shades, and that it is absurd to assume that the natural laws of light will be changed to conform to the desires of the manufacturer, who seems to wish to dictate just what shape of fixture shall be used.

New Telephone Patents.

WIRELESS TELEPHONY.

The wireless telephone has been used experimentaliy for some time, but it has always been seriously hampered because of the low energy of telephone currents. The practice for such working has been to earth both terminals of the transmitting circuit and likewise both terminals of its receiving circuit. The waves sent out from the two transmitting terminals, cutting the receiving terminals cause a flow of telephone currents in the receiving circuit. It will be readily understood how infinitesimal must be the received energy. To overcome this difficulty C. F. Collins proposes to augment his transmitted current by the use of the speaking

arc. He superimposes his transmitter fluctuations upon the arc in such a way as to increase greatly the effective power fluctuations. Mr. Collins has patented this combination of arc and wireless telephone.

SYSTEM OF PARTY RINGING.

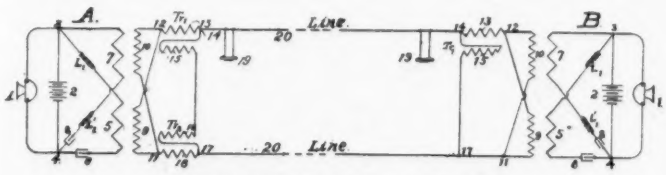
For farmer lines it has been found necessary from the commercial standpoint to connect a considerable number of stations to each line, and in signaling these stations code ringing has generally been resorted to. Many attempts to obviate this code ringing have but fixed the idea in the minds of telephone men of its necessity. Semi-selective ringing affords a considerable improvement in that the number of code rings required is lessened and because but one-half the bells are affected upon each ring. In this system one-half the bells are legged off each side of the line to ground.

A modification of this arrangement has been patented by L. W. Carroll, of Anamosa, Iowa, in which the bells are bridged, but the exchange drop is legged off one limb of the line to ground. In addition to this the generator at the stations is provided with a switch such that the generator may be either bridged or grounded. When the stations wish to signal each other the generator is operated bridged; for the exchange it is operated grounded. This system has the advantage over the semi-selective that the exchange is never called except when a connection to another line is desired. It has on the other hand the disadvantage of a more complicated code. The patent for the new system of ringing is assigned to the Kellogg Switchboard & Supply Company.

IMPROVED TRANSMITTING CIRCUITS.

There have always been recognized three methods of improving transmission: First, improving the power of the transmitting circuits; second, improving the sensitiveness of the receiving circuit, and third, improving the transmitting efficiency of the line. The last of these has received great attention of late and tremendous strides forward have been made. Further advance of the second was long ago abandoned because of the fact that the disturbances become amplified with the speech. The first has heretofore been effected first by gradually improved transmitters culminating in the "solid back" granular type; and second, by improved induction coils.

D. M. Therrell, of Charleston, S. C., has now improved the arrangement of the circuit itself, through purely electrical means. It is Mr. Therrell's idea that if the primary circuit may be arranged so that it resonates with the most prominent frequencies of the voice currents, a very much more powerful effect may be impressed upon the line. The general scheme is set forth diagrammatically in the accompanying figure, where it will be noted



THERRELL TRANSMITTING CIRCUITS.

that the induction coil is divided into parts each in an independent circuit, the transmitter being in another branch. There seems to be an error here which should be noted. It is claimed that the transmitter will affect the potentials about the condensers 6 and 8. If, as is fair to suppose, the battery, 2, is of constant potential within the limits of working, the effect of the transmitter will be insignificant unless a resistance or coil be included in the battery circuit, 3, 4.

Granting this resistance, it is readily understood that the difference of potential of the points 3 and 4 will be varied with the resistance changes of the transmitter. These variations will cause surgings in the coil primary circuits. The introduction of the condensers admits of tuning the various primary circuits each to a prominent voice frequency and thus largely overcoming the primary loss. An additional improvement lies in the compensating transformer, Tr_1 and Tr_2. This transformer is arranged to compensate as far as possible for the losses of transformation.

LETTERS TO THE EDITORS.

A. I. E. E. Election.

To the Editors of Electrical World:

SIRS:—The approaching election of officers of the American Institute of Electrical Engineers presents an opportunity for the expression of views which I have long held and which are held by many others (the majority, I hope) in the Institute, relative to the office of President. I desire particularly to express these views with reference to the coming election.

I believe that no man should be elected to the office of President of the Institute unless he has done a considerable amount of good and effective work in advancing the best interests of the Institute. These interests can best be advanced by writing papers; taking part in discussions; serving on Committees and those other and similar time-consuming, tedious, and, to the average man, distasteful kinds of work which are absolutely essential for the best success and advancement of the Institute and its aims.

I believe that the office of President should be held out as an extra inducement to men of high standing in electrical matters to do work for the Institute; as a reward for such work when done well and conscientiously and in a manner showing the candidate's fitness for office.

I have no sympathy whatever with the idea of making a man President simply and only because he is of high standing in electrical work. I know of no man who will confer an honor upon the Institute by becoming its President. On the contrary, the Institute honors the man whom it elects to that office. Such honor is due those men of high standing who have served the Institute's best interests.

For the ability and personality of both the present candidates for the office of President of the Institute, I have the highest regard. Besides ability and standing, one of these men has the additional qualification mentioned above; the other has not. If the former be elected, it will be due to his possession of the qualifications in question, and to the fact that he is well and widely known to the membership. If the latter is elected, it will be mainly due, I believe, to the fact that his friends have at their command the commercial organization of the immense manufacturing interest with which he is connected. If success should crown their strenuous efforts, it will constitute a most regrettable precedent.

NEW YORK. RALPH D. MERSHON.

To the Editors of Electrical World:

SIRS:—Enclosed you will find a copy of a letter which Mr. Ralph D. Mershon advises me he has asked you to publish. I also enclose copy of my reply which may interest you, and which you are at liberty to use as you may desire.

SCHENECTADY, N. Y. E. W. RICE, JR.

[The letter from Mr. Mershon enclosed is identical with that printed above, except that in the latter, in the fifth line from the end, the words "I believe" are added after the word "due." We print below the reply of Mr. Rice.—EDS.]

DEAR MR. MERSHON:—I have received your favor of April 2, enclosing copy of a letter which you propose to send to one or more of the electrical journals for publication.

I fully appreciate and reciprocate your friendly spirit and complimentary references to myself.

While I respect the views you have expressed, I presume it is scarcely necessary for me to say that I do not think that it is for the best interests of the Institute that the choice of President should be invariably limited in the manner you suggest.

It is true that owing to the great demands upon my time I have been unable to contribute much to the Institute papers or discussions. This has not been due to any lack of interest.

If elected President I would not only regard it as a great honor, but as a special call to work, to which I would respond to the

best of my ability by giving the necessary time and effort to the duties of the position.

I confess I do not understand the closing paragraphs of your proposed letter, in which you say, "If the latter is elected, it will be mainly due to the fact that his friends have at their command the commercial organization of the immense manufacturing interest with which he is connected. If success should crown their strenuous efforts it will constitute a most regrettable precedent."

I would heartily disapprove of the use of any commercial organization for election purposes. Of course, many of my friends are naturally associated directly or indirectly with our organization. Their votes have helped to elect past officers of the Institute. You surely do not mean to suggest that such men can be improperly influenced. In my opinion they would resent as quickly as yourself a suggestion to act in any manner not in absolute accord with their own personal views as to the best interests of the Institute.

I hope that the coming election will be in every respect conducted upon a plane in keeping with the best traditions and high character of the Institute. Yours very truly,

E. W. Rice, Jr.

[We desire to express our agreement with Mr. Rice in his comment on the suggested limitation of choice of President of the Institute. The custom of generations has been to select as the head of national and other professional and scientific bodies, men who have been leaders in the respective fields—whose work has been most fully representative of the higher aims of such bodies. To subordinate these considerations to those proposed would be apt to have two unfortunate consequences, particularly in the case of an engineering body. In the first place, the public at large and the many within a profession who do not keep in close touch with the society representing it, might have placed before them as representative of a profession one who, though an assiduous worker within the society, would be far from meeting this qualification. And second, a member of such a society who is in no sense a leader in his profession, but ambitious for its highest honor, might, under the proposed conditions, easily qualify himself for nomination by perfunctory contributions to the *Transactions* and discussions and by enforced activity in routine society work. Finally, in the specific case of the American Institute of Electrical Engineers under its present organization, the opportunities for acquiring most of the suggested qualifications would be very largely confined to members resident in New York City or vicinity.—Eds.]

The Magnetism in Induction Motors.

To the Editors of Electrical World:

Sirs:—The writer wishes to call attention to a fact connected with the space distribution of the flux in an induction motor which is not mentioned in the article on this subject by Messrs. H. F. and H. W. Connell in your issue for February 24. Messrs. Connell found that in the coils wound around the individual teeth of an induction motor there are induced sinusoidal e.m.f's equal in their effective values and shifted against each other as many electrical time degrees as the coils are placed electrical space degrees apart, which proves that the magnetic flux over the pole arc, as measured at the teeth, has a sinusoidal space distribution and travels synchronously around the air-gap, but it does not show that the ordinary assumption that the flux is proportional to the magnetomotive force divided by the reluctance is incorrect when applied to an induction motor.

In treating of the flux in induction motors it is necessary to consider both the primary and the secondary magnetomotive forces, the combined effect of which is to produce the apparent sinusoidal space distribution of flux when the rotor revolves at synchronous speed. It is to be noted, however, that the flux density must be constant from one current point to the next, properly considering both the primary and the secondary currents. Thus at that instant when a certain primary tooth is exactly opposite a secondary tooth, the primary tooth is submitted to a resultant magnetomotive force which is constant all over the tooth, and the flux density will be practically constant over the tooth area. It will be seen, therefore, that considering the tooth area, in distinction to the pole area, the space distribution of the flux is not sinusoidal. The actual instantaneous space distribution of the flux will depend upon the relative mechanical positions of the primary and secondary teeth. That is to say, the magnetic field varies slightly in form from instant to instant and revolves with a non-uniform speed, so that, in spite of the non-sinusoidal field, sinusoidal e.m.f's are generated.

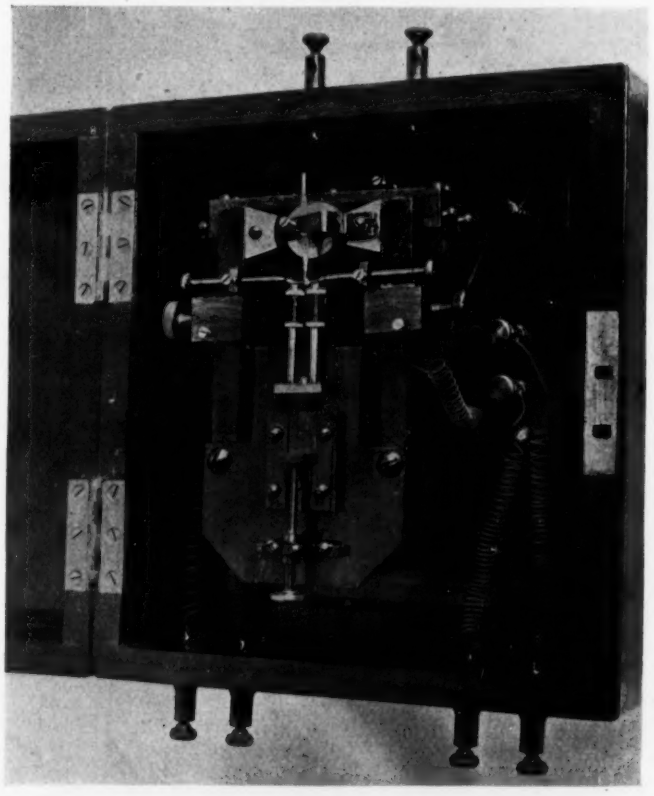
Although the final result is practically the same as though a sinusoidal magnetomotive force revolved synchronously around a non-uniform air-gap, the effect must be attributed in part to the mechanical shifting of the primary and secondary magnetomotive forces.

Hinsdale, Ill. R. E. Hellmund.

Polarized Relay.

To the Editors of Electrical World:

Sirs:—While in London in December, 1900, I was engaged making experiments with a view to developing a system of submarine signaling which required a polarized relay of much greater sensitiveness than any of the ordinary type, and failing to find anything of the kind either on sale or in the catalogues, I designed and made the one shown in the accompanying photo-



VIEW OF POLARIZED RELAY.

graph, which did the work easily, though obviously leaving much to be desired on the score of mechanical refinement.

It will be seen that the movable coil is mounted in jewels over a stationary core in the ordinary D'Arsonval manner, and the T-shaped aluminum needle has a light soft iron arc, capped with platinum at the contact end, which plays between the adjustable contacts on either side. The control is magnetic and adjustable over a wide range by means of the screw attached to the permanent controlling magnet; and since the angular motion of the contact cap need not be more than .02 mm. for the work intended, a high degree of sensitiveness may be attained with suitable proportions and coil resistance, by careful manipulation of the control. The coils shown on the permanent magnet arms are intended for use only when receiving unidirectional impulses

and are then inversely connected to weaken the control at the critical moment.

It is evident that many changes can be rung on this instrument, either by substituting a permanent magnet for the soft iron arc, with an eye to the polarities in reference to the main field, or giving a wide sweep to the major magnet to lessen its influence on the local field, etc., etc. But in practice with about the proportions shown the local field dominates the stray field at any useful point of adjustment.

These facts are evoked by patent No. 814,501, issued by the United States Patent Office on March 6.

RUTHERFORD, N. J. LEO DAFT.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Magnetic Induction and Hysteresis Loss in Armatures.—THORNTON.—A paper read before the New Castle Section of the British Inst. Elec. Eng., giving an account of experiments on the distribution of magnetic induction and on the hysteresis loss in armatures with toothed cores, hollow and solid. Two methods were used: First, the distribution of magnetic induction was directly measured by search coils wound in small holes drilled through the core parallel to the shaft. The second method was Hele-Shaw's method of observing stream lines in viscous liquids, which yields a vivid and graphic analogy to the unseen magnetic phenomena. The conclusions are summarized as follows: The magnetization of the teeth in slotted armatures is not alternating but rotating, and at the same time fluctuating; that of the core is rotating, but by reason of the distribution of density in the core not being uniform, it is unevenly distributed, being greatest at the outer parts below the teeth. The ratio of the mean dissipation coefficient to that corresponding to the mean density is found by the author's experiments to be about 0.8. The coefficient for the teeth alone is about 0.00105 joule per cubic centimetre per cycle; that for the core 0.00108. The low value for the teeth is caused by the drop in density between the poles and by the fact that it is rotating. An interesting conclusion is that the Steinmetz rule for calculating iron losses yields results which are too high in the case of the armature teeth. This is due to the fact that the flux through the teeth is not alternating, as is generally supposed, but rotating and fluctuating at the same time. This announcement is worth noting, for it happens occasionally that the flux density in the teeth of a particular machine is kept comparatively low so as to reduce the imagined losses in the teeth and the expected high rise in temperature. But if the losses are actually less than implied by the Steinmetz formula, the flux densities may be increased correspondingly.—Lond. *Elec.*, March 30.

Testing Induction Motors.—HOWE.—An account of tests of an induction motor by Bach-Wüg. The method employed is due to Bragstad, and is really an adaptation of the well-known method of finding the losses in one motor by driving it by another, which has been accurately calibrated. The motor used was a direct-current separately excited one, directly coupled to the induction motor under test. Four sets of readings were taken: (1) The power taken by the direct-current motor running light; (2) the power taken by the direct-current motor when coupled to the induction motor, both primary and secondary being open-circuited; (3) the power taken by the direct-current motor when the primary was connected to the polyphase supply, the secondary being open; and (4) the alternating-current power supplied to the primary in the latter case. Readings were made in all cases for various speeds, both above and below synchronism. The results obtained in this way on a 20-hp, six-pole, 50-cycle, three-phase motor are shown in Fig. 1, in which the curves are numbered to correspond with the four sets of readings mentioned above. Perhaps the most striking peculiarity of the figure is the sudden break in curves 3 and 4 when passing through the synchronous speed. Explanation of this break is given. The stator iron loss, *b*, is the mean of the two readings of the alternating-current power supplied to the stator at synchronism. The friction loss, *a*, is given directly as the difference between curves 1 and 2. The mean difference between curves 2 and 3 at synchronism gives the generally neglected loss in the teeth of the stator and rotor due to their rapidly pulsating flux. As the loss is caused by the rotation of the rotor, the power necessary to cover it must be supplied by the rotor, and will be included in the load on the direct-current motor in experiments 3 and 4 without affecting the reading of the stator iron loss on the alternating-current wattmeter. In the case of an ordinary induction motor running light, this loss in the teeth will have exactly the same effect as an increase in the friction and windage. The various losses in the example given work out as follows: Friction loss, 100 watts; stator iron loss, 250 watts; loss in teeth, 230 watts. The sum of these three amounts to 580 watts, whereas when running light in the ordinary way the losses amounted to 575 watts. This close agreement was found in all cases. The sudden break in curves 3 and 4 at synchronism amounts to 100 watts, corresponding to a hysteresis loss in the stationary rotor of 50 watts; at synchronous speed this loss is non-existent. In this example, therefore, two-fifths of the no-load losses were due to the rapidly-pulsating flux in the teeth. The results obtained by the author also show the inaccuracy of Benischke's assumption that the slip at no load can be taken as a measure of the no-load losses.—Lond. *Elec.*, March 30.

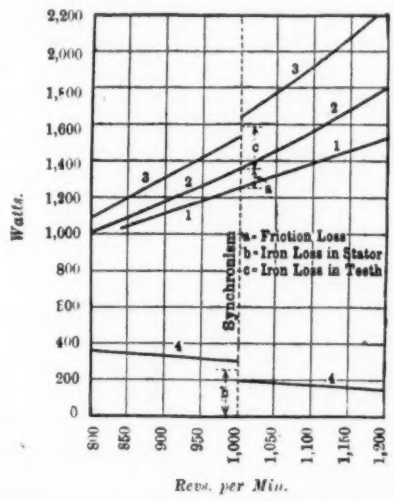


FIG. 1.—CURVES OF FRICTION AND IRON LOSSES.

Lamps and Lighting.

Mercury Arc.—CHILD.—An account of an experimental investigation of the conductivity of vapor from the mercury arc. The experiments of the author show that the space in the tube connected with a mercury arc becomes highly conductive. A luminous space gradually spreads out from the arc and the front of this region has the greatest luminosity and the highest conductivity. This conductivity is not due to ions coming from the arc, nor to rays sent out by it. It is not due to any leakage over the surface of the glass. It is probably not due to the high temperature of the gas. A probable explanation is that when ions first recombine, they are in a condition of unstable equilibrium much like the atoms of radio-active matter, and often break up again, this being a form of ionization which has not heretofore been studied. There is an e.m.f. between electrodes inserted in different parts of the tube. This is possibly due to the more rapid diffusion of the negative ions.—*Phys. Rev.*, April.

The Kuzel Lamp.—A note stating that Kuzel seeks leave to amend one of his patents for incandescent lamps, alleging as the

reason a misunderstanding on the part of his Vienna patent agent. He desires to insert the following words after the description of the means for reducing the refractible metals to a colloidal state: "These colloidal metals can be used either in a more or less liquid or gelatinous form, containing more or less of the imbibition liquid or in a solid form obtained as usual, for instance, by cautiously evaporating colloidal solutions, or drying such precipitated sols, gels or colloidal suspensions."—Lond. *Elec.*, March 30.—A description of the method of Bredig, which is said to be used by Kuzel for the production of the colloids, may be found in an article by Burton in *Phil. Mag.*, April.

Conductivity of Nernst Filament.—See abstract of the paper by Horton on conductivity of metallic oxides under "Electrophysics."

Power.

Electrical Equipment of Colliery.—Sparks.—An illustrated paper on the electrical equipment of the Aberdake collieries of the Powell Duffryn Company. They produce one and one-quarter million tons of coal per year. Six of the nine pits in this valley formerly had isolated direct-current plants generating at 200 or 400 volts for lighting and power purposes. One generating plant has now been erected which will serve the whole district, eight square miles in area. Some of the mines are four miles from the power station. The three-phase system at 50 cycles and 3,000 volts is used with overhead transmission lines. The existing direct-current motors are utilized, 19 motors having a total rating of 210 hp, being grouped at one pit and driven from the three-phase system by a motor-generator supplied by 3,000 volts. The power station is equipped to deal with an average load of 1,500 kw, this demand being met either by a 1,500-kw or two 750-kw sets during the day and one 750-kw set during the night and on Sundays. The alternators, one of 2,000 and two of 1,000 kilovolt-amperes, are three-phase star-connected. The transmission lines are designed to supply 6,000 hp in motors and consist of hard-drawn copper conductors supported on creosoted wooden poles. Substations are provided at the different mines. The motors may be divided into two classes: Variable-speed, for haulage and hoisting, and constant-speed, for driving fans, pumps, screens, conveyors, and machinery in workshops and a brickyard. Forty motors of the first type were at work in January, 1906, varying in rating from 300 hp to 25 hp, and 37 of the second type, from 180 hp to 5 hp, totalling 1,450 hp. Last January the total power at these pits was 12,170 hp, of which 4,710 was electric, the remainder of 7,460 being obtained from steam engines. Details are given on gearing and operation of the motors.—Lond. *Elec.*, March 23 and 30.

Electric Winding.—Hooghwinkel.—A paper read before the Newcastle Section of the (Brit.) Inst. Elec. Eng. and replying to some of the criticisms in a recent paper of Mountain which showed certain disadvantages of electric winding compared with steam hoisting. The present author criticizes this comparison as unfair, and considers main winding as not only a suitable application of electric driving, but as the principal and the most urgently needed application of electricity to colliery work.—Lond. *Elec.*, March 23.

Cranes.—An illustrated article on the application of direct-current motors for cranes and some accessories.—*L'Ind. Elec.*, February 10.

Traction.

Electric Traction on Main Lines in Europe.—Dawson.—A long illustrated article in which the author analyzes the steam railroad suburban traffic conditions about London and Berlin, and points out the necessity for the electrification of these lines. He also describes and compares the different systems of heavy electric traction and types of cars for suburban service in Europe. He reaches the conclusion that in addition to the disadvantages of the third rail and the greater cost of the direct-current, as compared with single-phase system, the latter presents so many advantages that it would appear to be the only system which with our present knowledge will fill nearly all the requirements of railway men, and is, therefore, the most suitable for handling the suburban traffic of our main line railways. Electrification of main lines, as far as long distance and goods traffic is concerned, may be made under special circumstances, but does not appear to be likely to be adopted in the near future, as far as Great Britain is concerned.—*St. R'y Jour.*, April 7.

Single-Phase Traction.—An illustrated article on the experimental single-phase traction installations on the Swedish state railways which have been repeatedly referred to in the Digest. A description is being given of the various types of apparatus used, and of the line construction which is being tried.—The same issue contains a note on single-phase equipment for the Central Illinois Construction Company.—*St. R'y Jour.*, March 31.—Ward Leonard replies in a letter to the criticisms by Lamme of his motor-generator system and says it is his present belief that "at the same speed, ventilation, hp, and other determining conditions the losses would be 100 per cent greater in the commutating single-phase motor system than in the direct-current series motor system, and that its weight would be about 50 per cent greater." He challenges Lamme to publish complete data and curves of the Westinghouse Company's New Haven locomotive, in which case he will publish simultaneously equivalent data on the Ward Leonard-Oerlikon locomotive.—*St. R'y Jour.*, April 7.

Transporter Bridge.—Webster.—A paper on the Widnes and Runcorn transporter bridge over the river Mersey. The bridge is similar in construction to an ordinary cable-stiffened suspension bridge; but instead of the costly high-level approaches, the traffic is carried across by means of a car suspended from a trolley running on the underside of the stiffening girders, and driven electrically.—Lond. *Elec.*, March 30.

Overhead Construction.—An illustrated description of the overhead catenary construction for the New York, New Haven & Hartford Railroad.—*St. R'y Jour.*, April 7.

Folding Step.—An illustrated description of a new folding step for tramway cars.—Lond. *Elec.*, March 30.

Electric-Gasoline Automobiles.—Hospitalier.—The internal combustion motor on automobiles has the disadvantage of lack of flexibility. The rational way of overcoming this draw-back consists in aiding electrically the internal combustion motor by combining it with a dynamo connected to a storage battery. This combined set represents a group which runs at practically constant speed at all loads since the dynamo with the storage battery furnishes the needed overload or consumes that part of the energy which is not needed. The author discusses application of this general principle on automobiles, tramways and electric boats. The same issue contains a description of a locomotive of Pieper for railways operated by the above system.—*L'Ind. Elec.*, February 10.

Electrophysics and Magnetism.

Conductivity of Metallic Oxides.—Horton.—An investigation of the variation of electric conductivity of solid metallic oxides with change of temperature, with a research into the question whether the conduction is carried on electrolytically or metallically. The oxides experimented on were lime, baryta, magnesia, bismuth trioxide, plumbic oxide, cupric oxide, sodium peroxide and quartz. Nernst has given reasons for supposing the conductivity of metallic oxides to be electrolytic, the chief of these being (*a*) that definite traces of electrolysis were found in some cases (the chemical composition at the cathode after the current had been allowed to flow through the oxide for a long time being found to be different from that at the anode); (*b*) the conductivity of a mixture of oxides was found to be much greater than that of each oxide separately. Nernst states that the products of electrolysis are continually recombining, and thus the supply of electrolytic ions is kept up. The conclusion of the present author from his experiments is just the opposite of this view and is that the conductivity of the oxides investigated is mainly metallic. In some cases a feeble polarization current or other signs of electrolysis were observed. In these cases both metallic and electrolytic conduction are assumed to be associated in the same substance. Some oxides, like *CuO*, show no trace of electrolysis, and the author thinks that if the conduction of electricity through these was carried on by means of electrolytic ions some evidence of the liberation of the pro-

ducts of electrolysis would have been obtained in the experiment in which a current was passed through oxide of copper while it was heated in a vacuum. The distinction between electrolytic and metallic conductivity is often based on the sign of the temperature coefficient of the conductivity of the conductor in question. If the conductivity decreases with the rise of temperature the conduction is taken to be metallic; if it increases with rise of temperature the conduction is considered to be electrolytic. But the author thinks that this rule is one with so many exceptions that it is useless for deciding the question. In cases of electrolytic conductivity the increase of conductivity with rise of temperature is due to the increased mobility of the ions at a higher temperature. The author thinks that the enormous increase of the conductivity of solid metallic oxides at higher temperatures cannot be explained in the same way, and that it is rather due to a large increase of the number of the negatively charged corpuscles which carry the current in the case of metallic conduction.—*Phil. Mag.*, April.

Phosphorescence.—Dieberne.—A paper in which the author advances a theory of phosphorescence based upon thermo-luminescence and the coloration of phosphorescent bodies by the radiation which excites them. Many phosphorescent bodies are colored during phosphorescence. This coloration is attributable to the formation of a new body, which persists after phosphorescence has ceased. When, however, the phosphorescent body is heated up to a certain temperature, the new body is decomposed, and gives up the energy consumed in its formation in the shape of thermo-luminescence. When no coloration is produced and there is yet a thermo-luminescence, it may be assumed that the new body is colorless, or has the same color as the original body. When there is no thermo-luminescence the probability is that the new substance is decomposed as fast as it is formed. This theory embraces all the facts of luminescence under a single aspect. It is well known that most phosphorescent substances are mixtures in which the real phosphorescent body is present in very minute proportions. It is this body that is sensitive to the exciting radiation. It may be transformed into several different bodies according to the exciting radiation used.—Lond. *Elec.*, March 30; from *Comptes Rendus*, March 5.

Heavy Canal Rays.—Gehrcke.—To account for the large masses of canal ray particles, the author supposes that they consist originally of metallic particles liberated by the disintegration of the cathode, and charged positively by the loss of electrons under the influence of the ultra-violet light. They are expelled from the cathode with a negative charge, but this is soon lost and converted into a positive charge, whereupon the particles are driven back towards the cathode. The varying size of the expelled particles accounts for the magnetic "spectrum" observed by Wien. The circumstance that the particles are derived from the metal, and from the gas, explains why the material of the canal rays is able to exceed the total gaseous contents of the vacuum tube, and also why the mass of the canal-ray particle may be as much as 650 times that of the hydrogen atom. These particles are large enough to be made visible by the ultra-microscopic method devised by Siedentopf and Szigmondy. That they occur in front of the electrode was already known to Goldstein, and their slow motion there is accounted for by their having to proceed for some distance against the electric force. When proceeding with it, they must show the Doppler effect discovered by Stark. The process by which the cathode disintegrates is still obscure. It is not solely due to the electric field, since disintegration may be produced by simple heating.—Lond. *Elec.*, March 30; from *Phys. Zeit.*, March 15.

Ions of Vapor.—Wilson.—An abstract of a (Brit.) Phys. Soc. paper on the velocities of the ions of alkali salt vapors at high temperatures. All the results so far obtained are consistent with the view that any salt of caesium, rubidium, potassium, sodium, or lithium gives in a Bunsen flame negative ions having a velocity of 1,000 cm. per second for one volt per cm. and positive ions having a velocity of about 80 cm. per second. This result can be explained by supposing that each salt molecule emits a negative corpuscle which forms the negative ion, and that the rest of the molecule forms the positive ion.—Lond. *Elec.*, March 30.

Ionization of Gases.—Tufts.—An account of an experimental investigation of the phenomena of ionization in flame gases and vapors.—*Phys. Review*, April.

Electrochemistry and Batteries.

Pig Iron Production in the Electric Furnace.—An illustrated account of the experiments carried out by Heroult at the "Soo," with the co-operation of the Canadian Government, of the reduction of pig iron from ores. One of the main points is that it is possible to use ores of high sulphur content for the production if pig iron containing only a few thousandths of one per cent of sulphur. Charcoal and peat coke can be substituted for coke as the reducing agent. An output of 12 tons of pig iron per day was obtained with 1,000 e.h.p. The same issue contains a letter by Sjöstedt on the production of ferro-nickel from nickeliferous pyrrhotite at the "Soo."—*Electrochem. and Met. Ind.*, April.

Electrolysis of Fused Salts.—Ashcroft.—The first article of a serial on factory-scale experiments with fused electrolytes. In the present installment the author deals with electrolysis of zinc chloride and lead chloride. After giving the general principles he deals with the construction of vats for fused electrolytes and with his method of stirring the electrolyte by electromagnetic means.—*Electrochem. and Met. Ind.*, April.

Production of Chlorates and Perchlorates.—Couleru.—A concise discussion of the fundamental principles of the electrolytic production of sodium chlorate from sodium chloride and of the perchlorate from the chlorate. Sodium chlorate may then be employed for the manufacture of potassium perchlorate and ammonium perchlorate which are useful in pyrotechnics and in the explosive industries.—*Electrochem. and Met. Ind.*, April; from *Chemische Zeit.*, 1906, v. 30, No. 21.

Hypochlorite for Sterilization.—Kershaw.—An illustrated review of the use of electrolytic hypochlorite as a sewage sterilizing agent in the United Kingdom. The different types of electrolytic hypochlorite cells are described and illustrated.—*Electrochem. and Met. Ind.*, April.

Colloidal Solutions.—Burton.—An experimental investigation of the properties of colloidal solutions prepared electrically by the method of Bredig. The chief results are as follows: The size of the diameters of the particles of gold, silver and platinum in the colloidal suspension lies between the limits 0.00002 and 0.00006 centimeter. The electro-negative non-oxidizable metals, gold, silver and platinum give solutions in water and ethyl malonate in which the particles are negatively charged. The electropositive, oxidizable metals give solutions in water, methyl alcohol, and ethyl alcohol in which the particles are always positively charged.—*Phil. Mag.*, April.

Electric Production of Ozone.—Ewell.—An account of an experimental investigation showing the superiority of the silent discharge obtained with an alternating current and the interposition of a thin dielectric of high dielectric strength between the electrodes over that obtained with point electrodes.—*Phys. Rev.*, April.

Units, Measurements and Instruments.

British Physical Laboratory.—A note on a recent annual report of the (Brit.) National Physical Laboratory. During the last year the ampere balance has been completed and Ayrton and Mather have carried out a series of determinations of the e.m.f. of a cadmium cell, in terms of the international ohm, and of the amount of silver deposited in a silver voltameter. The results are highly satisfactory. Fifty determinations of the e.m.f. of the cell have been made, and the greatest difference between any two is only 3 parts in 100,000. In the thermometric division the melting point of platinum has been carefully determined and has been found to be 1,710 + 5° C. The government will grant a sum of $50,000 for building during the coming year and will increase the actual grant by $2,500. It is hoped that the new electrical buildings may be opened on June 25, on the occasion of the visit of the foreign guests of the Institution of Electrical Engineers. The scheme of work for 1906 includes a research into the resistance of materials of construction to im-

pact, the continuation of the wind pressure and steam researches, the completion of the work with the ampere balance and some experiments of great interest on the effect of the continued application of high pressure to insulators. In the metallurgical division a research into the properties of aluminum bronze promises interesting results.—Lond. *Elec.*, March 30.

Measuring Insulation in Three-Wire Systems.—Muellendorf. In a three-wire system the neutral wire of which is not earthed, the total insulation resistance, R, of the network against earth in ohms may be found as follows: If E is the voltage between the outers and if by means of a voltmeter with an internal resistance of r ohms the tension, e_1, between the positive outer wire and earth and the tension, e_2, between the negative outer wire are determined, then

$$R = r\left(\frac{E}{e_1 + e_2} - 1\right)$$

This calculation may be avoided by the use of a voltmeter having its zero point in the center, the needle being deviated to either side according to the sign of the e.m.f. The scale of volts has uniform divisions, and below this scale a second movable scale is provided, having half the length of the upper scale and giving directly the ohms as calculated from the volts according to the above formula. The dial is shown in Fig. 2. The volt scale, I, goes on either side from 0 to 500. The ohm scale,

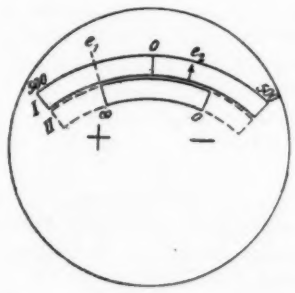


FIG. 2.—DIAGRAM OF DIAL.

II, goes from 0 to ∞. In using the instrument, it is first connected between the positive outer wire and the earth, giving a reading, e_1. The movable scale, II, is then revolved until the ∞ partition on II coincides with the e_1 partition on I. The instrument is then connected between the negative outer wire and the earth, whereby the needle is deviated to the right, giving a reading, e_2, on scale I. By taking the corresponding reading on scale II, the total insulation resistance is directly obtained in ohms, if scale II has been calculated from the above formula. —*Elek. Zeit.*, March 29.

Telegraphy, Telephony and Signals.

Loaded Telephone Lines.—Nowotny.—A paper giving some results obtained on the Austrian telephone lines loaded according to the system of Pupin. The installation of the lines began in 1905 and there exists now a loaded line of 803 kilometers length between Vienna and Triest. It consists of bronze wire three millimeters thick, induction coils being inserted at distances of four kilometers. It was found that half as many induction coils were sufficient to give the same improvement of transmission speech as the number actually installed. The Government has therefore removed half of the induction coils and will use them on other lines. Experience has shown that it is not necessary to keep the distance between two succeeding coils constant with absolute exactness and that it is sufficient to use the same average distance in a general way. It was found that the loaded line was influenced by currents in adjacent telegraph lines and by currents in transmission lines to a greater degree than ordinary unloaded lines. Moist weather and fogs have no bad effect on the loaded line. When half of the coils which had been installed in 1904 and 1905 were recently removed it was found that the self induction which had been originally 0.08 henry had decreased in most cases to 0.05 or 0.06 henry, but in some cases even to 0.03 henry. This was the result of magnetic remanence caused by occasional strong magnetization of some coils, perhaps due to atmospheric discharges, etc. By using a sufficiently strong alternating current the remanent magnetism of the iron cores of the induction coils could be removed which resulted in a considerable increase of the self induction. The suggestion is made whether it is not possible to design the induction coils in such a way that the influence of the permeability of the iron core is of less importance. It is suggested to use a double inductance coil for the conductors as is done on American lines.—*Elek. u. Masch.*, April 1.

Automatic Telephone Systems.—Kruckow.—An article in which the author expresses the opinion that a larger application of automatic telephone methods would be desirable in systems of medium size. In view of the high first cost and of the license to be paid, no saving is to be expected, although a change in this direction may be hoped for, when automatic telephony will be used to a larger extent.—*Elek. Zeit.*, March 29.

Miscellaneous.

Blast Furnace.—Richards.—The first article of a new serial of his metallurgical calculations in which he will deal specially with the iron and steel industries. The first installment of this serial gives the balance sheet of the blast furnace. The materials put into the blast furnace are fuel, iron ore, fluxes and blast. The materials discharged are pig-iron, slag, gases and dust. The author discusses in detail the resolution of each of the four materials charged into the four avenues of escape, numerical examples being given.—*Electrochem. and Met. Ind.*, April.

Process of Combustion.—McElroy.—A discussion of the Eldred process, the underlying idea of which is to mix air with certain regulated amounts of carbon dioxide "for the purpose of obtaining certain relative proportions or partial pressures of oxygen and carbon dioxide, and ultimately obtaining therewith what may be called an 'auto-combustible' mixture having certain mutual relations of the partial pressures of carbon dioxide, carbon monoxide and free oxygen." Products of combustion are chosen as a source of carbon dioxide on account of being cheap and convenient.—*Electrochem. and Met. Ind.*, April.

Ignition.—Soulier.—An illustrated description of various electromagnetic ignition systems exhibited at the eighth automobile exposition in Paris.—*L'Ind. Elec.*, February 10.

Cable Ship.—A fully illustrated description of the cable gear and equipment which was recently made by an English firm for the new cable ship which the Japanese government is now building in Japan.—Lond. *Elec.*, March 23.

BOOK REVIEW.

Die Drahtlose Telegraphie. By Dr. Eugen Nesper. Berlin: Julius Springer. 157 pages, 29 illus. Price, 3 marks.

This small book is mainly a commercial prospectus of the different wireless telegraph systems in Europe and America. It gives the organization of each company; a list of its officers; the amount of its capitalization; some idea of the commercial work done, and a list of the stations owned or equipped by the company.

Perhaps the best part of the book is the bibliography given at the end. This list contains some 1,100 titles of books and papers on wireless telegraphy and electric waves. The list, however, although a large one, is not nearly complete. Thus, for instance, it does not include the important papers of Pierce in the *Physical Review* or of Ives in the *Electrical World and Engineer*. It is, nevertheless, probably the best biliography of the subject yet published.

There are some excellent pictures of apparatus scattered throughout the book. On page 95 is an interesting picture of Major Squier's receiving apparatus attached to a tree. The scope of the book is indicated by the following headings: Technique; historical development; organization; commercial activity; technical characteristics of the different systems; insurance; legislation and questions of neutrality; wireless telegraphy in war; the future of wireless telegraphy; list of stations of the different companies; bibliography of literature and patents.

Technical Publicity Association Meeting.

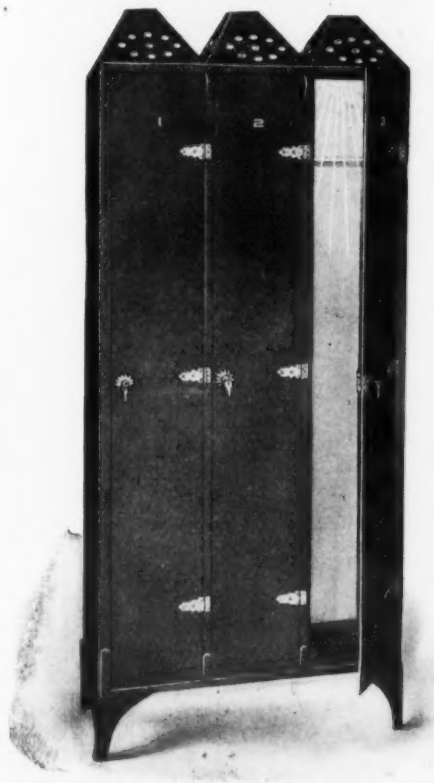
At the second annual meeting and banquet of the Technical Publicity Association, held Thursday, April 5, at the Aldine Association, New York, the following officers were elected: President, F. H. Gale, General Electric Company; first vice-president, H. M. Cleaver, Niles-Bement-Pond Company; second vice-president, C. B. Morse, Ingersoll-Rand Company; secretary, Rodman Gilder, Crocker-Wheeler Company; treasurer, H. M. Davis, Sprague Electric Company. Members of Executive Committee—Robert L. Winkley, Pope Manufacturing Company, and G. M. Basford, American Locomotive Works. Members Election Committee—C. W. Beaver, Yale & Towne Manufacturing Company; Charles N. Manfred, Johns-Manville Company, and H. M. Kress, A. S. Cameron Steam Pump Works.

P. F. Kobbé, former president of the Association, and now an advertising specialist, was the guest of the evening, and gave an address on the general subject of advertising. An informal discussion followed in which members and guests took part. Among those companies represented at the banquet besides those mentioned above were American Wood Working Machinery Company, *American Machinist, Railroad Gazette,* John A. Roebling's Sons, De La Vergne Machine Company, A. A. Griffing Iron Company.

The membership of the Association shows a steady increase, and its finances are in good condition. The following resolution was unanimously passed: Resolved, that the Association shall take active steps to secure definite information regarding the circulation of mediums in which the members of the Association are interested.

Lockers for Central Station Employees.

The accompanying illustration shows a clothes locker for employees in central stations and in other places brought out



ELECTRICALLY-LIGHTED LOCKER.

by the Metropolitan Engineering Company, 1250 Atlantic Avenue, Brooklyn. The lockers are made entirely of steel plates so as to be both substantial and fireproof, and in the dome of each locker is fitted an electric lamp which lights when the door is opened, enabling one to see whatever is in the locker. The outside of the locker is finished in any desired style, but a gun-metal surface is recommended for the best wear. The inside is finished in white enamel and the gauze basket at the bottom is finished in bronze, as are also the hangers; the doors are fitted with Yale locks. Inasmuch as lockers are usually situated in out-of-the-way places which are usually dark and unattractive and unavailable for other purposes, the incandescent lamp lighting up the contents of the locker when opened is deemed to be a great advantage.

Some New Small Electric Tools.

The General Electric Company has recently developed a number of small motor adaptations, including an electrically-driven bench drill suitable for small work, a portable electric breast drill for the same range of requirements and an electric buffing and grinding outfit for household use. The bench drill has been particularly designed for the use of jewelers, repairmen and manufacturers who have a large amount of drilling on small work or otherwise where the drilling service is not severe. It is furnished with a vertical motor mounted on the top of a column sliding in a socket cast integrally with the base, in which it can be adjusted for various heights. The motor body or head is also adjustable radially for drilling position.

The whole outfit rests on a broad base about 6x10 in. which gives the desired stability. The minimum height is 16 in. when the motor arm is in the lowest position, and the maximum height is 22 in. when the motor arm is fully raised, thus giving a range of 6 in. through which the motor body may be raised or lowered. The work is fed to the drill by raising a circular table which is operated by a lever with a range of 1¼ in. vertically.

The motor is series wound for 115 or 230 volts and for direct-current circuits only. A single gear reduction is provided between the armature shaft and drill spindle. The hand wheel mounted on the armature shaft at the top is convenient for turning the spindle and adds a fly-wheel effect to the spindle as well, thereby insuring a smooth, steady rotation of the drill. The amount of power required in the operation of the drill naturally

FIG. I.—BENCH DRILL.

varies with the amount of work performed. The largest drill the chuck will hold is 21/64 in. diameter, and from this all sizes down to No. 40. The bearings are provided with self-oiling cups, which require attention only every three or four months. The outfit includes a chuck of standard design. The weight of the bench drill complete is about 40 lb., which insures firmness and rigidity.

The motor used in the portable electric breast drill shown in Fig. 2 is similar in size and construction to that used with the

bench drill just described. The tool is provided with a switch in the body of the motor so conveniently arranged as to bring the drill under absolute control of the operator. This switch is well protected from damage, of suitable design and sturdy

FIG. 2.—PORTABLE BREAST DRILL.

construction. The weight of the breast drill is 16 lb. complete, and it measures 13 in. long by 5 in. diameter. The outfit includes a chuck. The oiling of the bearings is effected through protected oil holes which replace the self-oiling features of the bench

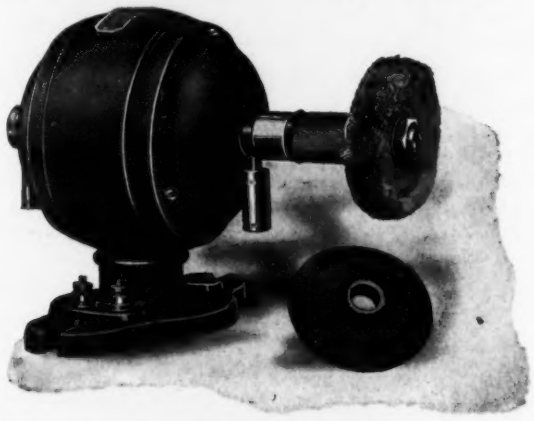


FIG. 3.—GRINDING AND BUFFING OUTFIT.

drill motor. The use of a self-oiling bearing in which oil is stored is not practical with these drills as the breast drill is used in all conceivable positions, and oil could not be prevented from escaping out of the reservoirs. On this account the bearings of the breast drill must be oiled frequently. An extension cord permits a range of operation within a radius of 10 ft. from the source of current. The domestic grinding and buffing outfit,

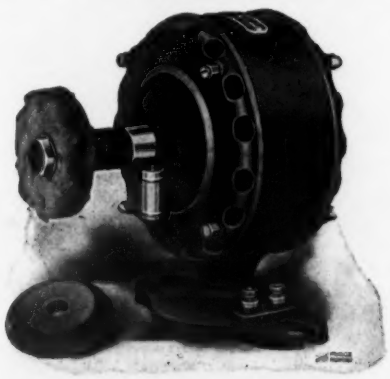


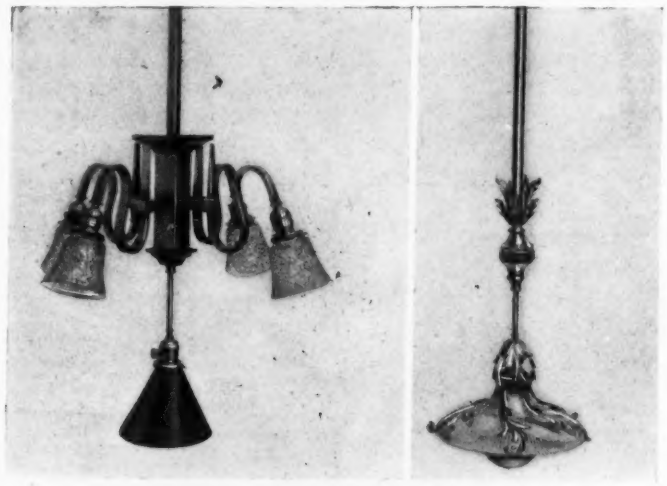
FIG. 4.—GRINDING AND BUFFING OUTFIT.

shown in Figs. 3 and 4, has been especially designed for grinding knives, scissors and other similar edged tools and for polishing small silverware, jewelry and other like articles. A grinding wheel of suitable character to insure a smooth cutting edge without the use of a second sharpening is interchangeable with the buffing wheel. These outfits are adapted for the intermittent service required in the ordinary household, but are not suitable for the heavier continuous work which is required by jewelers, dentists, etc. Other and larger outfits are made by the General Electric Company for this more exacting service.

The household outfit consists of motor with shaft extended 2 in. from end of bearing to inside of wheel, the necessary washers and nuts for holding the wheel in place, one rag wheel of 3½ in. diameter, one 3-in. emery wheel ½ in. thick with ⅝-in. bevel face, together with attaching plug with 10 ft. of cord. These outfits are furnished for 110 volts direct current and 110 volts alternating current and may be specially wound for 220 volts. The alternating-current motor weighs about 25 pounds. The direct-current motor is much lighter, weighing but 15 lb. Both motors are very simple, requiring no more attention in service than a fan motor. In connecting to source of current supply the cord is attached to the binding posts of the motor and the plug inserted in the nearest socket at which the proper current is available.

Adjustable Fixtures.

The Adjustable Fixture & Manufacturing Company, of Greenville, Ohio, has recently begun the manufacture of a very useful adjustable fixture under the patents of H. C. Ayres, formerly superintendent of the Greenville Electric Light & Power Com-



FIGS. 1 AND 2.—ADJUSTABLE FIXTURES.

pany. Fig. 1 shows a handsome fixture with one adjustable reading lamp partially lowered. Fig. 3 is a drawing showing

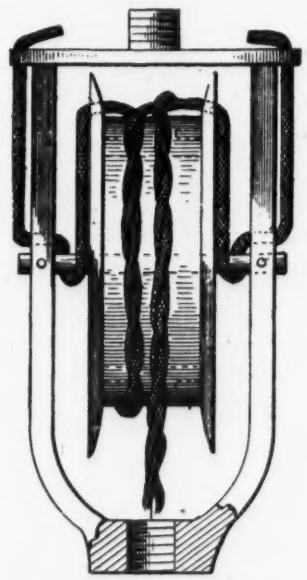


FIG. 3.—COILING DRUM.

the construction inside the canopy of such a fixture while Fig. 2 is a one-light pendant with the adjustable feature. The reading lamp in Fig. 1 is mounted on a brass rod which slides up and

down inside the chandelier. It can, therefore, be pushed up as if it were a regular bottom socket on the chandelier, or pulled down so as to be close above the reading lamp. In most cases it would be desirable to equip the adjustable socket with a more ornamental reflector than the green opal cone shown, but Fig. 1 illustrates the idea. The fixture is especially useful in the average living room of a small residence where reading or sewing is to be done and at the same time the general lighting of the room must be provided for. The adjustable fixture shown is much superior to the ordinary extension plug and cord used for lowering a light from a chandelier. The flexible cord from the adjustable socket winds around a drum in the canopy of the fixture. There is sufficient spring tension from a spiral spring inside this drum so that the cord always winds up when the adjustable rod is pushed up. There are no moving contacts as the cord after winding around the drum and around the shaft on which the drum is mounted is soldered directly to the outlet wires. The one-light pendant works upon the same principle. The president of the Adjustable Fixture & Manufacturing Company is Mr. D. L. Gaskill, president of the Greenville Electric Light & Power Company.

New Shops of the Allis-Chalmers Company.

The new shops of the Allis-Chalmers Company, now building at West Allis, Milwaukee, when completed will add 180,000 sq. ft. to the plant's present floor area of 62,000 sq. ft. and make the entire plant capable of affording employment to 11,000 men. These works when finished, together with the capacities of the other plants of the company in Milwaukee, Chicago, Cincinnati and Scranton, will be capable of affording employment to no less than 18,000 persons.

The extensions at West Allis consist of three machine shop units parallel to three existing units, the dimensions of two of these being 575 ft. by 145 ft., the third being 575 ft. by 168 ft.; an erecting shop 1,136 ft. by 113 ft. forming an extension to the present erecting shop and adjoining the six machine shop units; an extension of the existing foundry which has a total length of 994 ft. and a width of 222 ft., and an extension of the pattern shop and storage building, which has the same length and width of 119 ft. The work in constructing these extensions involved

FIG. 1.—VIEW OF ERECTING SHOP.

an expenditure of over $3,000,000. The extensions to the erecting shop and pattern shop have been practically completed and substantial progress has been made on the remaining buildings.

The machine shop units are constructed to form two principal bays in cross-section, with a framing so spaced longitudinally as to form 36 bays, each 16 ft. wide. One of the principal bays is 65 ft. wide and 52 ft. high, and is served by a 50-ton crane with 44-ft. lift and a span of 67 ft. The other principal bay is 71 ft. wide and 42 ft. high with a gallery floor about 26 ft. above the main floor. This bay has a line of intermediate columns making the north division 40 ft. with a runway for a 10-ton crane having 38-ft. span and 17-ft. lift. A mezzanine floor suspended from the gallery floor girders is devoted to coat rooms and various service rooms. Three elevators of the plunger type serve the mezzanine floor and gallery.

The foundry is provided with a crane runway for a 60-ton crane with a 78-ft. span and 27-ft. lift. One of the bays has a runway for a 30-ton crane with 66-ft. span and 24-ft. lift, and the other for a 20-ft. crane of 30-ft. span and 34-ft. lift. Besides these traveling cranes the central bay and east bay are provided with traveling bridge cranes on both sides.

The existing power house contains three steam-driven, 250-volt, direct-current units, one of 550 kw, another of 300 kw and another of 100 kw; also a 150-kw, direct-current generator direct-connected to a two-cylinder tandem Nürnberg gas engine. To this equipment will be added a steam-driven 1,000-kw direct-current generator.

The heavy machine tools of various kinds installed in units

FIG. 2.—VIEW OF FOUNDRY.

Nos. 1, 2 and 3 will be duplicated for units 4, 5 and 6 and supplemented by tools suitable for specific service, as for example the building of steam turbines and turbo-generators, gas engines, etc. One order recently placed covered forty-two machine tools of extra heavy pattern, involving an expenditure of $550,000. These tools were all designed especially for use with high-speed steels and driven by Allis-Chalmers motors. The combined weight of these tools within the motors used for driving them aggregates 2,141 tons. Fourteen of the new machines are vertical boring and turning mills from 8 to 16 ft. and extra heavy in design. There are five standard shaft lathes and two crank shaft lathes with a swing of from 60 to 125 in., and 30 ft. between centers; eight planers of various sizes, all of which are the spiral geared type; a 260-ton armature press, also several drilling and boring machines, slotters, etc. Over 1,200 hp in Allis-Chalmers motors will be required to drive the new equipment described. In addition to the machine tools, 34 electric traveling cranes have been ordered for sizes and capacities ranging from 2½-ton wall jib cranes to 60-ton, 78-ft. span cranes with 10-ft. auxiliary hoist for the foundry extension.

The system used for storing patterns and which renders each readily available for use when required is greatly simplified by the use of electric telphers, running through the various sections and by push cars and elevators. The telphers are supported on overhead I-beams and have a capacity of three tons each.

Direct current at 250 volts is distributed throughout the building for operation of motors used for machine tool drive. These motors are largely operated on the Ward Leonard multiple-voltage, five-wire system (Bullock system of control for variable-speed motors), making 27 different speeds possible for each machine.

The yards between the various units are as completely equipped with cranes as the interior of the buildings, the storage space thus made available, proving very serviceable. Seven cranes are provided for use between the various machine shops and the foundry and pattern shop.

Of the accompanying illustrations, Fig. 1 gives a view of the erecting works looking north, and Fig. 2 a view of the foundry.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—The weather conditions favored retail trade, and improvement in collections is noted, but some country districts are still calling for funds. Crop reports are very good except from a few localities where there has been wet weather. Among the industries favorable features are the activity in building, the partial settlements and advances granted, in the central and western bituminous coal fields, and better inquiry for and stronger tone of pig iron, the consumption and production of which break all records. The total output of iron, 2,165,632 tons, was 261,600 tons greater than February, and showed an increase of 96,739 tons over January, the previous record month. March railway earnings are still by far the best ever recorded in March. The demand for steel rails continues heavy, while inquiries for 1907 delivery are developing. Structural material is active, and further new business is pending. Coal is in better demand at the East, and prices are a little stiffer, but in the West it is reported that prices have receded. Copper is steady, but business is lighter. Steady and large demands for electrolytic copper were reported by local sellers and buyers. Refiners are hard pressed for deliveries, especially for account of wire makers, all of whom are far behind the demands for trolley wire, for which there is a rush of orders for the sorts that weigh 2,129, 2,687 and 3,382 lb. to the mile. Telephone and telegraph lines and makers of cables and insulated wire for electrical engineering are all pushing for wire to the extent that is compelling the rushing of work on extensions to existing wire drawing works. There is no change in quotations for copper. Lake is 18⅝ to 18¾c. and electrolytic 18½ to 17⅝c. for June and July delivery. Casting copper is held at 18 to 18¼c. for thirty days' delivery. Business failures for the week ending April 12, as reported by *Bradstreet's*, numbered 161, against 151 the week previous, and 196 the corresponding week last year.

DEMAND FOR WESTINGHOUSE-PARSONS TURBINES.—The Westinghouse Machine Company, of East Pittsburg, during the months of February and March, received orders for 35 steam turbines aggregating approximately 50,000 brake hp capacity. The most important equipments were those ordered by the Transit Development Company, Brooklyn, 7,500 kw; Toledo Gas & Electric Company, 3,000 kw; Los Angeles Pacific Railway Company, 2,750 kw; Detroit United Railways, 1,200 kw; Columbia (S. C.) Electric Street Railway Company, 3,000 kw; St. Paul Gas Light Company, 1,500 kw; Grand Trunk Railway Company, for St. Clair Tunnel, 3,000 kw; Detroit, Monroe & T. S. L. Railway, 1,200 kw; Northern Heating & Electric Company, St. Paul, 1,000 kw, and Griffin Wheel Company, Chicago, 1,000 kw. The largest is of 7,500 kw capacity, or 11,000 brake hp, and will be installed by the Transit Development Company. It is of the well-known multiple expansion parallel flow type and will drive a direct-connected alternating-current generator at 750 r.p.m., developing 10,000 electrical hp at full load. By means of a secondary governor valve, with which all Westinghouse-Parsons turbines are provided, 12,000 kw may be developed when running condensing, or full load when operating without condenser. This corresponds to a maximum capacity of at least 16,000 hp at the shaft. A number of machines of similar capacity are being built by the Westinghouse Machine Company for large power houses in New York, Brooklyn and other cities.

ALLIS-CHALMERS APPARATUS.—The Bellefontaine Bridge & Iron Company, of Bellefontaine, Ohio, has purchased Allis-Chalmers electrical machinery as follows: A 75-kw type "H" generator, eight direct-current motors aggregating 35 hp, together with 8 starters for same. The American Steel & Wire Company, of Anderson, Ind., has purchased a 200-kw type "I" generator built at the Cincinnati works of the Allis-Chalmers Company. The Ellsworth Coal Company, of Ellsworth, Pa., is a recent purchaser of a new lot of Allis-Chalmers electrical machinery. The new equipment will consist of a 500-kw direct-current rotary converter, four 14-hp motors and four 7½-hp motors. Charles H. Besley & Co., of Beloit, Wis., has purchased electrical machinery as follows, to be furnished by the Allis-Chalmers Company: A 60-kw generator, a 30-hp induction motor, a 20-hp induction motor and a 2.4-kw exciter. The Russell Engine Company, of Allegheny, Pa., will install a 75-kw Allis-Chalmers type "I" generator recently purchased. The Anderson & Middleton Lumber Company, of Aberdeen, Wash., are purchasers of a 25-kw Allis-Chalmers type "I" generator and a 9-in. by 9-in. Lycoming engine. All the above apparatus will be built at the Cincinnati works.

SALES OF ECONOMIZERS.—Among recent sales of economizers made by the B. F. Sturtevant Co., Boston, Mass., may be noted the following: New Orleans Railway & Light Company, New Orleans, La.; Raritan Copper Works, Perth Amboy, N. J.; Lawton Mills Corporation, Plainfield, Conn.; Haverhill Electric Company, Haverhill, Mass.; Malden & Melrose Gas Light Company, Malden, Mass. An example of the Sturtevant economizers operating under the unusually high pressure of 225 to 250 lb. per sq. in. is found in the power house of the New Orleans Railways Company. The sections were tested to 500 lb. per sq. in. in the Sturtevant shops and to 400 lb. after erection. Each of the six economizers of the first installation is 10 pipes wide and 36 pipes long, making a total of 2,100 pipes with over 26,000 sq. ft. of heating surface. The boilers served by these economizers are rated at 6,480 hp; thus there are about four square feet of economizer surface per boiler horse-power. The engineers for the company recommended the Sturtevant so favorably that a second order for three more economizers, each 10 pipes wide and 12 pipes long, has recently been received. These are to be used in the Claiborne station.

ELECTRIC CABLE FACTORY.—The new factory of the Electric Cable Company, which is now in course of construction at Bridgeport, Conn., will be completed the latter part of April. A reception will be given on the date of its completion to the members of the Bridgeport Board of Trade, to the employees of the company and to the engineers and workmen who were at work on the building. The plant will be devoted to the manufacture of Voltax, the new insulating compound, of magnet wire, rail bonds and field and armature coils. These coils are to be insulated with the Voltax compound impregnated under a vacuum to insure thorough absorption and to make the product moisture and water-proof. The Electric Cable Company reports an increase of 50 per cent in the sales of its field and armature coils during February and March over the two preceding months.

STURTEVANT GENERATING SETS.—The very rapid increase in output of Sturtevant generating sets, manufactured throughout by the B. F. Sturtevant Co., of Boston, Mass., is shown by recent orders received from P. Barbey & Son, Reading, Pa.; Chrome Steel Works, Chrome, N. J.; American Sapphire Company, Moore, Mont.; Northern Central Railway Company, Canton, Md.; Ogdensburg Coal & Towing Company, Ogdensburg, N. Y.; S. Slater & Sons, Inc., Webster, Mass.; F. B. Allen, Swanee, Ont.; Cresson Springs Brewery Company, Cresson, Pa. Sturtevant marine generating sets are to be installed upon the steamer *W. S. Porter*, built by Newport News Shipbuilding & Dry Dock Company, Newport News, Va.; Canadian Government yacht *Speedy*, the Dominion Government Toronto dredge and the Toronto Ferry Company's new boat, *Bluebell*.

PELTON WATER WHEELS.—The Pelton Water Wheel Company has received from a large corporation in British Columbia an order for a Pelton unit with which is incorporated 15,000 ft. of sheet-steel riveted pipe. From the Orient has come an order for a complete equipment to operate under two separate heads, conditions being such that two independent streams afford heads of 630 ft. and 420 ft., respectively, with varying water quantities. This involves two wheels of different diameters mounted on the same shaft, which is direct-connected to an electric generator by means of Pelton flexible leather link couplings. A single governor controls both wheels by means of stream deflecting hoods on the nozzles. Also from the Orient comes an order for an iron-mounted Pelton unit for driving a 300-kw generator under an effective head of 580 ft., the wheel to have 500 horse-power maximum capacity. The Alaska Electric Light & Power Company has ordered a three-wheel double-nozzle unit for operating under a head of 225 ft.

INTERPOLE RAILWAY MOTORS.—The Electro-Dynamic Company, of Bayonne, N. J., has decided to enter the electric traction field with a railway motor embodying the features of its interpole motor, which has met with so much success in stationary power work. Among the specific claims made for this motor in connection with electric railway work is its absolute sparklessness, great flexibility in speed regulation, high torque for a given amount of material and consequently smaller size for a given work than motors of other types, and much less cost of installation owing to its capability of utilizing higher voltages than the ordinary direct-current motor. It is stated that tests have shown that higher average speeds can be obtained with interpole railway motors than with other types, or that the same schedule speeds may be met with smaller currents and lower brake pressures with the same amount of energy consumption. In the specific case for which calculations have been made for a double equipment of 40-hp interpole motors on a 17-ton car, a saving of 25 per cent in energy was found to be possible in a one-mile run retaining the same schedule made with ordinary motors. The Electro-Dynamic Company will soon make public its designs of high-speed interpole railway motors, especially for trunk line service.

HEAVY FOREIGN TRADE.—The country's foreign trade in March exceeded all previous records for that month. The statement issued by the Bureau of Statistics of the Department of Commerce and Labor shows that the exports increased $8,543,913 over March, 1905, while imports increased $3,193,878. These increases bring the exports of the month up to $145,522,342 and imports up to $113,625,066. The preponderance of exports over imports, which amounted to $31,897,276, show substantial increase over the record for 1905, but has been exceeded three or four times in the past ten years. The record difference was in March, 1898, when the exports exceeded the imports by $51,058,313. The record for the nine months give the unprecedented total of exports of $1,343,913,725, or not less than $430,329,139 in excess of the imports.

THE ATLANTIC DE FOREST WIRELESS COMPANY has announced the closing of a contract with the New York & Cuba Mail Steamship Company (Ward Line) for the installation of the De Forest system on its fleet of steamers. The first installation will be placed on board the new Ward Liner *Merida*, which will go into commission April 21, leaving New York on that day on her maiden trip to Havana. The steamship company is building a handsome operating room of steel on the upper deck, just aft of the smoking room for the accommodation of the wireless.

REYNOLDS-CORLISS ENGINES.—The Hornbeak Milling Company, of Hornbeak, Tenn., will install a 10-in. by 24-in. Reynolds-Reliance Corliss engine, purchased from the Allis-Chalmers Company, Milwaukee. Henrich's Sons, of Buffalo, N. Y., have also recently purchased an 18-in. by 42-in. Reynolds Reliance Corliss engine.

POWER IN IDAHO.—The Inland Power & Electric Company, of Spokane, Wash., has acquired 20,000 horse-power at Albany Falls, Idaho, 20,000 horse-power at Hell Gate in the Columbia River, and an additional power at Metalline Falls on the Pend d'Oreille River. The company is incorporated for $1,000,000.

POWER HOUSE FOR SEATTLE.—Mr. F. B. Kilbreth, of New York City, has been awarded a contract for the construction of a reinforced concrete power house at Seattle, Wash., at an estimated cost of $500,000. Stone & Webster, of Boston, are the engineers.

Financial Intelligence.

THE WEEK IN WALL STREET.—Activity on the stock market was restricted, but prices were strong. No special features of importance developed, the present attitude of the market being one of waiting for easier money and for a definite outcome in the anthracite coal situation. The bond market was stagnant, the high price for money restricting the demand for such securities. United States Steel stocks were rather firm on the better bituminous coal outlook and on the news of renewed improvement in the iron and steel trade. Business in electric securities was rather limited, but prices were firm, some advances being recorded. Allis-Chalmers common closed at 22, which is a net gain of ⅜ point, but preferred lost the same amount, closing at 57½. General Electric closed at the highest quotation of the week—172—this being a net loss of 1 point. Westinghouse gained 1¾, closing at 161¾. The traction stocks are all higher, Brooklyn Rapid Transit closing at 87⅞—a gain of 1⅛—and Metropolitan Street Railway at 155, an advance of ⅝ point. On the curb the last quotation of Interborough-Metropolitan common was 54 and for preferred 90⅛, these quotations being net gains of ⅜ point in each case. Western Union is a shade lower, the closing price being 92⅛, and American Telephone & Telegraph closed at 138⅛, which is a net decline of 1⅛. The curb market was quiet throughout the week, with early heaviness, followed by general recoveries. The features were late strength in Mackay Companies, the traction issues, and two or three low-priced copper stocks. Indications were that the latter movements resulted from manipulation, which desired to stimulate interest in the curb again. For some weeks past the outside public has done next to nothing in curb stocks. Chicago Subway, Interborough-Metropolitan, Gold Hill Copper and Union Copper were active and strong late in the week. Following are the closing quotations on the Stock Exchange April 17:

NEW YORK

	Apr. 10	Apr. 17		Apr. 10	Apr. 17
Allis-Chalmers Co	20⅝	22¼	General Electric	168¾	171⅜
Allis.Chalmers Co. pfd	56⅜	57⅛	Hudson River Tel	...	...
American Dist. Tel	...	*39	Interborough Rap. Tran	225	...
American Locomotive	67¼	69⅛	Mackay Cos	64⅜	65
American Locomotive p'd	114¼	115	Mackay Cos pfd	72⅛	73⅛
American Tel. & Cable	91	92	Marconi Tel	...	...
American Tel. & Tel	138	137	Metropolitan St. Ry	115¼	116⅜
Brooklyn Rapid Transit	84⅛	87⅛	N. Y. & N. J. Tel	...	...
Electric Boat	27	...	Western Union Tel	91⅜	92¼
Electric Boat pfd	65	...	Westinghouse com	156	163
Electric Vehicle	10	...	Westinghouse pfd	...	...
Electric Vehicle pfd	18	19½			

BOSTON

	Apr. 10	Apr. 17		Apr. 10	Apr. 17
American Tel & Tel	139	138½	Mass. Elec. Ry. pfd	68	67
Cumberland Telephone	..	...	Mexican Telephone	4⅜	...
Edison Elec. Illum.	...	...	New England Telephone	141	140¾
General Electric	...	..	Western Tel. & Tel	...	...
Mass. Elec. Ry	19	20	Western Tel. & Tel pfd	...	84½

PHILADELPHIA

	Apr. 10	Apr. 17		Apr. 10	Apr. 17
American Railways	52⅝	53½	Phila. Electric	7⅞	8¼
Elec. Co. of America	11⅜	11⅛	Phila. Rapid Trans	27⅛	28¼
Elec. Storage Battery	78	78	Phila. Traction	90	99¼
Elec. Storage Battery pfd	...	...			

CHICAGO

	Apr. 10	Apr. 17		Apr. 10	Apr. 17
Chicago City Ry	150	152	National Carbon	90	92
Chicago Edison	...	154½	National Carbon pfd	120	118
Chicago Subway	53⅛	56¾	Union Traction	...	...
Chicago Tel. Co	...	110	Union Traction pfd	...	...
Metropolitan Elev. com	26	26			

* Asked

PHILADELPHIA ELECTRIC.—The annual meeting of the stockholders of the Philadelphia Electric Company was held last week. By the largest vote ever recorded, 655,000 shares being represented, the stockholders elected the following directors: Thomas Dolan, Jeremiah J. Sullivan, William F. Harrity, Chas. E. Ingersoll, John V. Shoemaker, J. R. McAllister, William P. Conover, Jr., A. V. R. Coe and Joseph B. McCall. President McCall read the annual report, which showed that the income for the year has been sufficient to provide for the payment on the Edison Electric Light stock trust certificate 5s, the Philadelphia Electric gold trust 5s, the Philadelphia Electric gold trust 4s and the dividends on the stock of Philadelphia Electric amounting to $499,935, leaving a balance of $511,081 for transfer to surplus account, thus increasing the balance of credit to said account as of December 31, 1905, to $1,411,737. President McCall stated that the total number of 16-cp lamps connected December 31, 1905, was 1,072,143, an increase of 103,873, or 10⅞ per cent of the connected power of last year. He called attention to the fact that the total connected load had doubled within the last five years. President McCall also called attention to the reduction in the rate for private and commercial lighting, which went into effect January 1, 1906. He said that this would temporarily affect the income of the company, but that the great increase in the business of electric lighting had justified the company's policy. Mention was made of the purchase of the building at Tenth and Chestnut Streets. Contracts have been awarded for the erection of a seven-story office building on the site, which will be completed by February 1, 1907.

MARYLAND ELECTRIC.—The annual meeting of United Railway stockholders recently did not bring forth any announcement of immediate financial reorganization, excepting that the Maryland Electric Company, which is controlled by friendly interests, shall finance plans for improvements and betterments. The promise is also made of an early resumption of dividends on the income bonds. Gross earnings for the year showed an increase of $575,224.89; earnings in excess of operating expenses, etc., $2,258,406.

DIVIDENDS.—Directors of the New England Telephone & Telegraph Company have declared the regular quarterly dividend of 1½ per cent, payable May 15. The directors of the Grand Rapids Railway Company have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable May 1. The regular quarterly dividend of 1¼ per cent on the preferred stock of Butte Electric & Power Company has been declared, payable May 1. Directors of the Henry R. Worthington Corporation have declared the regular semi-annual dividend of 3½ per cent on the preferred stock, payable May 1. The Pacific Gas & Electric Company has declared its first dividend on the preferred capital stock, payable April 15, for the quarter ending March 31, and for $1.50 per share, or at the rate of 6 per cent. This preferred stock was taken share for share by the holders of California Gas & Electric stock. It now bears interest at double the rate of the old stock, said interest being guaranteed under the trust agreement filed at the time of the gas merger. Directors of the International Steam Pump Company have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable May 1. The directors of the Michigan State Telephone Company have declared a regular quarterly dividend of 1½ per cent on the preferred stock, payable May 1. Chicago Edison Company's directors have declared the regular quarterly 2 per cent dividend, payable May 1. A regular quarterly dividend of 1¼ per cent has been declared on the preferred stock of the Columbus Railway Company. The directors of the National Steel & Wire Company have declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable May 2. A semi-annual dividend of 4 per cent has been declared by the Lowell (Mass.) Electric Light Company directors, payable May 1. The directors of the Automatic Electric Company have declared the regular quarterly dividend of 2 per cent, payable May 1. The directors of the Milwaukee Electric Railway & Light Company have declared the regular quarterly dividend of 1½ per cent on the preferred stock.

THE WATER POWER ELECTRIC COMPANY, of Hickory, N. C., recently incorporated, is beginning with a capital stock of $250,000, which may be increased later to $700,000, the maximum authorization, and 6 per cent 30-year gold bonds to the amount of $250,000. The company has secured a water power three miles north of Hickory on the Catawba River, which will develop 6,000 hp. A power plant will be erected at that point for the generation and transmission of electricity to Hickory, where it will be supplied to the Thornton Electric Light & Power Company. The latter company will distribute the current for the operation of mills and factories and the proposed street railway system. It is proposed to build a concrete dam 30 ft. high, both rock and sand being available at the site. Plans and specifications are being prepared, and it is stated that bids for the construction will be received probably in June. The cost of the work is estimated at $250,000. Extensive improvements are also proposed at Hickory, which include a street car line out to the river, where a farm has been acquired and will be converted into a park. Col. M. E. Thornton, president of the Thornton Light & Power Company, will be the president of the new company. Robert E. Zell, of Birmingham, Ala., is consulting and superintending engineer.

NATIONAL LEAD.—The annual report of the National Lead Company shows net earnings of $2,082,632, the largest in the company's history and an increase of $486,939 over those of 1904. President Cole says that the company expects to pay dividends on the common stock, beginning July 1. The United Lead Company, the purchase of which was accomplished since January 1, is not mentioned in the President's report, but he says that the concern has demonstrated an earning capacity sufficient to take care of the fixed charges on the additional securities issued to pay for the new properties and "leave a handsome addition" to the net revenue of the National Lead Company. Payment has been made to the United Lead Company's stockholders by the issue of $5,713,600 of preferred and $5,750,000 of common stock of the National Lead Company, provided for last June, when the capitalization was increased from $30,000,000 to $50,000,000. The report shows a decrease of $985,000 in accounts and notes payable, which were liquidated out of the surplus of net earnings. Notwithstanding these payments, the surplus has increased $486,939, and is at present $3,554,596.

CONSOLIDATION IN VIRGINIA.—It is stated that behind the merger of all the electrical traction and lighting properties around Norfolk, Va., exclusive of those controlled by W. J. Payne, of Richmond, and Alexander Brown & Sons, of Baltimore, are moneyed interests in the United Gas & Improvement Company, of Philadelphia. The merger is to be under the name of the Norfolk & Portsmouth Traction Company and the capitalization is to include $6,000,000 in stock and $8,000,000 in bonds. There will be an issue of $3,500,000 of bonds and $5,000,000 of stock. R. Lancaster Williams, now president of the Norfolk Railway & Lighting Company, which owns the largest properties absorbed, is to be president, and E. C. Hathaway, now general manager of the Norfolk Railway & Lighting Company, general manager. The company will build a new interurban line from Portsmouth to Suffolk and Smithfield, Va., and control new lines to be extended to the Jamestown Exposition grounds on Hampton Roads.

DEVELOPMENT IN ATLANTA.—The common stock of the Georgia Electric Company has reached par recently, and was selling around $25 three years ago. Since that time, the company has been making a remarkable record of earnings. For the year ended with December 31, 1905, it earned $550,573 for the common stock equal to $9 per share upon the $6,000,000. The common stock in August, 1905, was placed upon a dividend basis of 4 per cent. For the 1905 year the net earnings increased over the previous year 25.33 per cent. The company is showing earnings for the common stock at the rate of about $12 per share. The Georgia Railways & Electric Company controls the street railways, gas and electric lighting facilities of Atlantic, Ga.

MICHIGAN UNITED RAILWAYS.—Articles of association have been filed by the Michigan United Railway Company, capital $5,000,000. This company means the combination of the Lansing Suburban from Lansing to St. Johns, and the Lansing City line, the Jackson and Battle Creek, including the Battle Creek city lines, and the Michigan Traction Company from Jackson to Kalamazoo and Cull Lake. It is the intention of the company to finish building the line from Lansing to Jackson. With George E. More, Myron W. Mills and James R. Elliott, are associated New York capitalists. The consolidation will have 185 miles of electric road.

CHICAGO TELEPHONE COMPANY reports a gain of 2137 telephones for March, and a total in use of 150,184. President Wheeler says: "During the past five years we made 10 3-100 per cent on our average investment of about $15,000,000. The percentage of net to capital was 11 62-100. Reductions in rates under our offer to the city amount to $797,104, or 5 7-10 per cent on $14,000,000 capital. The difference or about 6 per cent would be what we would show on the same business under the same conditions, but with the lower rates. We have made only one proposition to the city and are waiting to see what objections there are to it."

TELEPHONE EXPENDITURE.—The directors of the Michigan State Telephone Company have authorized additional expenditures for new construction sufficient to make the total expenditures throughout the entire State $1,800,000. Of this amount $1,000,000 approximately will be expended in Detroit. The construction work will be financed in part by the issuance of securities.

POWER FOR THE SOUTH.—The Southern Power Company, of South Carolina, has ordered eight 4,000-hp electric generators, twelve 2,500-hp oil-insulated, water-cooled transformers, and auxiliary apparatus from the Westinghouse Electric & Manufacturing Company. This is said to be the largest order for this class of apparatus that has ever come from the South.

MANILA EARNINGS.—The earnings of the Manila Electric Railway & Lighting Corporation for the month of March are reported as follows by J. G. White & Co.: Railway, gross, $42,500; net, $20,000. Light, gross, $28,500; net, $13,700. Total, gross, $71,000; net, $33,700. The property bids fair to exhibit rapid gains and is doing well.

WESTINGHOUSE MACHINE OFFICERS.—The directors of the Westinghouse Machine Company have increased the number of vice-presidents from two to four and have elected E. H. Shiffin and Arthur West to fill the new offices of third and fourth vice-president, respectively.

SAN FRANCISCO TROLLEYS.—The stockholders of the United Railways Investment Company of San Francisco at a special meeting in Jersey City last week, ratified the plan for the purchase of the Philadelphia Company. The decision was by a two-thirds vote.

INTERNATIONAL STEAM PUMP.—A special meeting of the stockholders of the International Steam Pump Company has been called for May 8 for the purpose of considering the acquisition of some additional properties.

GENERAL NEWS.

Construction Notes.

BIRMINGHAM, ALA.—A certificate of the increase of the capital stock of the Birmingham Railway, Light & Power Company from $6,000,000 to $7,000,000 has been filed.

BESSEMER, ALA.—C. M. Braddy, of Atlanta, connected with the construction department of the Southern Bell Telephone & Telegraph Company, is making arrangements for the reconstruction of the entire system in Bessemer and tributary points including Brighton and Jonesboro.

NOME, ALASKA.—Preliminary work has been commenced on the construction of a large electric plant at Salmon Lake, on Pilgrim River. It is given out that the plant will be of sufficient size and capacity to supply the entire Seward peninsula with power and light. W. L. Leland of the Three Friends Mining Company is interested in the work.

FLAGSTAFF, ARIZ.—The Flagstaff Mutual Telephone Company proposes to put in an automatic system next year.

PRESCOTT, ARIZ.—F. W. Nelson is soliciting subscriptions to build a long-distance telephone from Holbrook to Springerville and other points.

KINGMAN, ARIZ.—The Las Animas Power & Water Company, of Durango, Col., will soon begin work on its big power plant near this place. Arrangements have been made to conserve a much larger body of water from Cascade and Lime Creeks. The company will increase its equipment and will generate between 30,000 and 40,000 hp. The plans of the company include the driving of a seven-mile tunnel.

PHŒNIX, ARIZ.—The Arizona Telephone & Telegraph Company is considering plans which involves rural ownership of telephone lines and will connect 99 per cent. of the residents of this valley by telephone. The company is offering to furnish without cost to the subscriber a transmitter and receiver, the signal service and the telephone line to be paid for by the subscribers. In addition to this they pay fifty cents a month for the service of the city exchange.

EUREKA SPRINGS, ARK.—G. U. Matthews writes that he and C. M. Barnes, are to construct an electric light plant, to cost $35,000, and want a turbine wheel of 500-hp capacity.

LOS ANGELES, CAL.—The Edison Electric Company has begun the erection of a power house to cost $60,000.

LOS ANGELES, CAL.—Contracts for the construction of the Main Street lighting system have been let to the Llewellyn Iron Works for $17,739.

SAN FRANCISCO, CAL.—The Ocean Shore Railroad Company has filed amended articles of incorporation increasing its capital stock from $300,000,000 to $5,000,000.

SAN FRANCISCO, CAL.—It is understood that the management of the Palace Hotel has decided to order a steam-driven electric lighting plant for the use of the Palace and Grand hotels.

OAKLAND, CAL.—Contracts are being let by the Oakland Home Telephone Company and the construction of the plant will begin May 1. It is expected that the plant will be installed by January 1, 1907, with 5,000 telephones.

REDONDO, CAL.—C. C. Moore & Co., of Los Angeles, have secured the contract for constructing a steam power electric plant at Redondo, for the Pacific Light & Power Company, to cost about $1,000,000. About 25,000 hp will be generated.

VALLEJO, CAL.—At a recent meeting of the City Trustees, J. W. Hartzell, a railroad financier and builder, made an application for a 50-year franchise to construct and operate an electric street railway to connect North and South Vallejo, through the principal streets of Vallejo.

VALLEJO, CAL.—It is stated that the $3,000,000 bonds of the new San Francisco, Vallejo & Vaca Valley Electric Railroad Company have been sold, and that arrangements are about complete for the commencement of construction work on the branch road between Vallejo and Benicia.

MARYSVILLE, CAL.—At a recent meeting of the Board of Supervisors, Frank W. Anderson, of Wheatland, made application for a fifty-year franchise to operate a telephone system throughout the County of Yuba. Anderson asks the Board that the franchise be offered for sale and to fix a day for receiving bids as required by law.

SAN FRANCISCO, CAL.—Rudolph Spreckels has announced that the Municipal Railroad, of Francisco, will soon file articles of incorporation, with a capital stock of $14,000,000. There will be five directors, including Claus Spreckels, Rudolph Spreckels and James D. Phelan. It is the intention of the new company soon to ask for a franchise on Bush Street.

LOS ANGELES, CAL.—From its headquarters in Los Angeles comes the announcement that the work of installing a Home telephone system in San Francisco will begin shortly. On April 21 the franchise applied for by the Empire Construction Company will be sold by the municipality. As there are no other telephone companies trying to enter the field the Home plant is practically assured. It is estimated that two years time will be required to erect the large plant and system which will be automatic. The cost of construction will exceed $6,000,000.

LOS ANGELES, CAL.—All the holdings of the Riverside Power Company have been sold by the Southern California Savings Bank of this city to the cities of Santa Ana, Anaheim and the Pacific Light & Power Company. With the sale of the company's assets is conveyed the title to riparian rights to 6½ miles of the Santa Ana River banks. The headworks are at the Salt Lake bridge over the Santa Ana, and of its waters the company owns an average of 2,500 miners' inches. The price paid for the plant was $150,000. The power is now used for lighting Riverside.

CROCKETT, CAL.—In the expectation of quadrupling the output of the Crockett sugar refinery in the near future, the management has commenced installing electric motors, which will eventually replace steam in the operation of the big plant. Seven additional boilers are to be installed in the lower floor, and these will supply steam to the big compound Corliss engine in the main building, and will also operate the generator. This generator will supply all the power needed in the different departments of the refinery, as well as the lights in the buildings and the Crockett Hotel.

YREKA, CAL.—The extension of the Yreka Railroad from Yreka, its present terminus, to the towns of Fort Jones, Greenview and Etna in the Scott Valley is to be built by Scott & Van Arsdale, of San Francisco. Alex. J. Rosborough, the local representative for the new road, is the secretary of the Siskiyou Electric Power Company, and negotiations have already been entered into between the builders of the proposed extension and the electric company regarding the application of electricity to the running of this road. If the engineers report favorably the road will undoubtedly be electrified.

YREKA, CAL.—The Siskiyou Electric Power Company has entered into an agreement with W. W. Wright, superintendent of the Dewey Mining Company, near Gazelle, Siskiyou County, wherein Mr. Wright signifies his intention to organize a sub-electric company for the extension of a power line into the southern portion of Siskiyou County. It is estimated that the cost of extending these lines will be in the neighborhood of $75,000. The power to be used will be purchased from the Siskiyou Electric Power Company and delivered at Montague. The proposed line will run to Gazelle, Edgewood, Weed, Upham, Sisson, Shasta Springs, Shasta Retreat and Dunsmuir, and to the town of McCloud. A revenue of $2,000 a month has already been guaranteed the sub company. Under the terms of the contract, the purchase of electricity is for ten years, with option to buy this sub company or renew the lease.

FRESNO, CAL.—An order for 10,000 poles has been placed by the San Joaquin Power Company. A branch line will be built to Dinuba, Reedley, Sultana and Orosi, running west after making the circuit to a junction with the Visalia line. Four miles west of Selma, on the Hanford line, a substation will be erected from which a line will be run east into Selma and west into the Caruthers country, where it will be used for pumping. It is also proposed to extend the west branch to Summit Lake, where there is a demand for electric power for pumping purposes. From the plant that is now being built above Porterville, a line will be run to Porterville, thence west to tie with the Fresno system at Corcoran. Also from a point due south of Tulare a line will be built north to tie with the Fresno system at Dinuba. Another line contemplated will be built north to Madera.

DANIELSON, CONN.—Amendments to the borough charter will be prepared enabling and empowering the borough to own and operate a public water system and also an electric light and power plant.

WINDSOR, CONN.—The electric light company has ordered a new 175-kw,, three-phase, alternating-current generator to be added to the equipment of the plant. It is expected to be ready by May 1.

NORWICH, CONN.—The Torrington Building Company, of Torrington has been awarded the contract for the erection of the new power house for the Norwich-Westerly Railway Company, which will be located just south of Hallville. The building will be ready for occupancy June 15. There will be considerable machinery installed, including eight Franklin 1,600-hp motors, three 400-kw generators, three 500-hp Hamilton Company's engines, and other necessary equipment.

WILMINGTON, DEL.—The Wilmington Light, Power & Telephone Company has issued $500,000 bonds for construction purposes.

SMYRNA, DEL.—A Benoy boiler has been installed in the municipal electric light and water plant. A new 65-kw Warren dynamo will be put in some time this month. Harry B. Crienes is secretary.

WILMINGTON, DEL.—The Wilmington City Railway Company has placed contracts for new equipment calling for an expenditure of $400,000. The improvements to be made extend to all departments of the system. A battery of four 400-hp boilers has been ordered from the Heine Boiler Company, of Phoenixville, Pa., and two additional generators, one of 800 and the other of 600 kw capacity, from the General Electric Company. These generators will be direct-connected to two engines to be built by Robert Wetherill & Company, of Chester, Pa.

JACKSONVILLE, FLA.—The County Commissioners have granted George W. Clark, owner of Panama Park, the right of way for an electric railway here. The new line will extend from the intersection of Main Street and the city limits, run along Main Street to Lawton Avenue at Panama Park, thence east on Lawton Avenue to Buffalo Avenue, to Virginia Street, thence to Cummer's road, and south to Talleyrand Avenue to the city limits.

DUBLIN, GA.—A syndicate has applied for a street railway franchise on the streets of Dublin.

ATLANTA, GA.—The City Council has decided upon an appropriation for the installation of a number of new incandescent and arc lamps in various parts of the city.

COLUMBUS, GA.—The Columbus Power Company has purchased property on Second Avenue to be used as a site for the proposed steam plant which will generate about 3,000 hp.

ATLANTA, GA.—J. D. Jacquish is at the head of a movement to build an electric railway from Atlanta to Gainesville, Ga. It is possible that the North Georgia Electric Company will supply the power.

ACWORTH, GA.—H. M. Putnam, city clerk, writes that it is proposed to construct water works and an electric light plant, at a cost of $12,000 or $15,000. J. B. McCrary, of Senoia, is engineer.

ROCKMART, GA.—Contracts for constructing an electric light plant, for which bids were opened April 9, have been awarded as follows: Boilers, to Walsh & Weidner Company, Chattanooga, Tenn.; engine to Harrisburg Foundry & Machine Company, Atlanta; electric apparatus, arc light system, switchboard and alternator to Ft. Wayne Electric Company, Ft. Wayne, Ind.; transformers and lamps to Newcomer-Maney Company, Atlanta, and heaters and pumps to Platt Iron Works, Dayton, Ohio. Joseph M. Roman & Co., Century Building, Atlanta, Ga., are engineers for the company.

COTTONWOOD, IDAHO.—The business men of this city have decided to install an electric lighting plant at a cost of about $3,500, which amount has been subscribed.

BOISE, IDAHO.—D. J. Winslow has secured an option on the Snake River Ox Bow power site from the owners, Charles Mullen, Dr. W. D. Springer, F. W. Hunt, John H. Meyers, R. M. Fairchild and the David Heron estate. The price to be paid is $25,000. The power site is one of the largest in this section of the State. It is located on the Snake River 50 miles below Huntington. By putting in a 25-foot dam and driving a tunnel through the lava rock a distance of 1,400 feet, a fall of 50 feet is secured for the entire volume of the river. Competent engineers estimate that 25,000 hp may be generated at low water.

FREEPORT, ILL.—The Pecatonica River Power Company has increased its capital stock from $5,000 to $100,000, and the general offices have been changed from 99 Stephenson Street to the plant in Silver Creek Township.

LINCOLN, ILL.—Lincoln Water & Light Company has recently purchased from the General Electric Company series alternating 7.5 ampere arcs to take the place of "Wood" open 9.6 ampere lamps. E. MacDonald is superintendent.

CENTRALIA, ILL.—Centralia & Central City Street Railway Company and Centralia & Central City Street Railway Company have been consolidated under the name of the Centralia & Central City Traction Company, with a capital of $4,110,000.

FREEPORT, ILL.—The Freeport Railway, Light & Power Company has presented a petition to the village Board of West Freeport for a franchise to construct and operate a street railway, electric lighting, heating and power plant in that village.

DUQUOIN, ILL.—St. Louis and Kansas City capitalists, represented by Albert B. Moebusa, of St. Louis, and C. W. Prince, Jr., of Kansas City, are about to apply for a franchise and right of way for a traction line to be constructed from this city to Terre Haute, Ind.

WAUKEGAN, ILL.—Agents of the Chicago Telephone Company are surveying a route between Chicago and Milwaukee for putting the main wires in conduits in order to better protect them. The route is largely along Sheridan Road near here. Permission will be asked from city an county authorities for the change from poles.

GALESBURG, ILL.—It is reported that the Central Union Telephone Company will make a number of changes and additions to its lines during the spring and summer. One of the additions is to be another copper metallic circuit between Galesburg and Bushnell, which, when completed, will make four toll lines between the two cities. A copper metallic circuit has just been completed between Bushnell and Roseville and a new circuit will soon be completed between Bushnell and Carthage by way of Plymouth.

CANNELTON, IND.—Work has begun on the city's new electric light plant. The authorities are now in the market for the installation of the plant.

WESTVILLE, IND.—A franchise has been granted to E. S. Smith, E. T. Scott and others to construct and operate a telephone exchange at this place.

DUNKIRK, IND.—The Dunkirk Lighting Company is contemplating making some improvements in its plant in the near future. T. R. Kent is secretary.

EARL PARK, IND.—The franchise recently granted to W. C. Ditton for a water and electric light plant has been referred to a vote of the people for ratification.

WABASH, IND.—The Home Telephone Company of this city will erect a new business block for its own use and install a $10,000 central-energy multiple switchboard.

DECATUR, IND.—The city contemplates installing a series alternating-current street lighting system in the municipal electric light plant. W. J. Mylott is superintendent.

MARION, IND.—City of Marion electric light department has asked for bids for one 150-kw, 60-cycle dynamo to be installed in the city electric light plant. Otto Weesner is superintendent.

HAMMOND, IND.—The Town Council has granted a franchise to the New York & New Orleans Electric Company by which it obtains the use of several streets in the town over which it proposes to operate an electric railway.

ANDERSON, IND.—The Remy Electric Company of this city has increased its capital stock from $50,000 to $75,000 for the purpose of improving and enlarging the plant. The company will also install some new machinery, it is said.

SHERIDAN, IND.—The Town Council contemplates installing in the city electric light plant a gas engine and producer plant to displace the present steam plant, and replacing a 75-kw with a 100-kw alternator. W. M. Robbins is superintendent.

KENDALLVILLE, IND.—The Chicago & Toledo Traction Company is erecting a large power house in this city which will develop 5,000 kw when completed. Sterling water tube boilers and turbo-generators will be installed. F. E. Johnson is superintendent.

TIPTON, IND.—Tipton Electric Light Company is contemplating stepping its pressure up from 2,200 volts to 6,000 volts and extending a line at that voltage to Windfall, eight miles from Tipton, for the purpose of furnishing the town with light and power. The work will probably be done this spring. J. H. Stewart is manager.

EVANSVILLE, IND.—By a vote of 5 to 4 the City Council refused to grant a thirty-five-year franchise to the Citizens' Telephone Company. The Council recently granted a thirty-five-year franchise to the Cumberland Telephone Company, and did not think it wise to vote a dual telephone system on the city. The Citizens' Company will make another effort to get a franchise through the Council.

CHIGLEY, I. T.—M. Wolf, of Old Washita, is trying to interest the citizens in the construction of a telephone line from here to Davis.

WASHINGTON, IA.—The plant of the Iowa Gas & Electric Company has been purchased by the Washington Illuminating Company.

GUTTENBERG, IA.—The Home Electric Company has succeeded the Guttenberg Electric Light, Heat & Power Company, Guttenberg, Ia., and will begin the rebuilding of the entire plant at once. B. G. Houck is secretary.

IDA GROVE, IA.—A number of Ida County farmers from Hayes, Blaine, Silver Creek, Grant, Corwin and Logan townships held a meeting in Anderson's hall in Ida Grove recently to plan the organizaton of a farmers' mutual telephone company in this vicinity.

PRATT, KAN.—The Pratt Ice & Light Company has secured a franchise for an electric light plant.

CALDWELL, KAN.—A proposition has been made to issue $15,000 in bonds to install a municipal electric light plant in this city.

MADISON, KAN.—D. C. Callen has made a good many new improvements in the electric plant here since he took charge of the same.

TOPEKA, KAN.—The city municipal street lighting system plant contemplates changing from open to enclosed arcs. H. K. Goodrich is superintendent.

OTTAWA, KAN.—J. H. Bell, city clerk, writes that the citizens voted April 3 to purchase the water work and electric light plant and will make improvements to same. Engineer, Owen Ford, Security Building St. Louis, Mo.

LARNED, KAN.—G. W. Smith, proprietor of the Larned electric light plant, is installing a 15-ton ice plant in connection with the light plant and is putting in a new 150-hp boiler and 14x36 rolling mill type Murray engine.

LOUISVILLE, KY.—The Louisville & Eastern electric line has been granted right of way over the State pike from Shelbyville, Ky., to the fair grounds.

MADISONVILLE, KY.—James L. Brown, City Clerk, writes that bids will be received about May 1 for the construction of a municipal lighting plant; probable cost, $25,000.

LOUISVILLE, KY.—The Board of Aldermen on April 3 adopted a resolution authorizing the Board of Public Works to prepare a contract with the Louisville Lighting Company for one year at $74 per lamp per year, the company to furnish electricity at 10 cents per kw-hour.

LAFAYETTE, LA.—An election will probably soon be held to vote on issuing $35,000 bonds for extending the electric light service and for water mains.

RUSTON, LA.—The City Council has granted a franchise for the operation of a street railway in Ruston. The proposed line will run to Chatauqua and Lincoln Parish Fair Grounds, outside the city.

EUNICE, LA.—Ira W. Silvester, of Alexandria, La., a civil engineer, has been looking over the town and making an estimate of the probable

cost of an electric lighting and water works plant, which the Town Council proposes to install in the near future.

EL DORADO, KAN.—The El Dorado Light, Heat, Ice & Power Company, with a capital of $50,000, has been granted a franchise to build a gas and electric light plant in this city and has been given the contract for lighting the streets.

NEW ORLEANS, LA.—At the annual meeting of the New Orleans Railway & Light Company, President Foster stated that work contemplated and under construction includes the completion of the power house and the addition to the Claiborne station, and other extensions.

PORTLAND, ME.—The Portland Lighting & Power Company is to establish a new substation in which 800 hp will be developed by steam. The contracts for equipment are let.

SOUTH PORTLAND, ME.—It is understood that the U. S. Government contemplates quite an extension of its electrical equipment at Fort Williams and that an additional building will be required for the dynamo, etc.

FRYEBURG, ME.—Fryeburg Electric Light Company has suspended operations for the present on account of failure to get the supply of power according to contract. The company is now considering the development of ample water power in the near future. C. E. Harris is secretary.

BANGOR, ME.—Pembroke and Perry are to be lighted by electricity in the near future, it is said. The water power privilege of C. H. Sprague & Son, of Pembroke, for the possession of which Boston parties have been negotiating for several months, has finally been transferred to the latter, who have acquired by the deal the old Pembroke Iron works also. Work on the proposed power station and the erection of 12 or more miles of poles will be commenced at an early date.

AUGUSTA, ME.—The Kennebec Light & Heat Company will soon commence some improvements in the equipment of its power station at the east end of the Kennebec dam which will increase to a considerable degree its already excellent facilities for furnishing light and power to Augusta and other places in the vicinity of the city, which means the introduction of new and modern machinery to take the place of some which has become obsolete. One of the important changes will be the installing of a 675-hp turbine, direct-connected to a 500-kw generator, to replace the engines now in use.

BALTIMORE, MD.—The Board of Estimates has decided to increase the price to be asked for a franchise on German Street for the United Railways Company from $7,500 to $15,000.

NORWOOD, MASS.—The citizens have vote to construct a municipal electric light plant, to cost about $25,000.

WORCESTER, MASS.—A proposition is being discussed for the city to purchase the plant of the Worcester Electric Light Company.

NORWOOD, MASS.—The citizens of Norwood have voted to appropriate $25,000 for the erection of the new municipal distributing electric plant.

SHEFFIELD, MASS.—It is reported that the Berkshire Power Company, of Canaan, is contemplating furnishing electric lights in this village.

FALL RIVER, MASS.—Plans have been completed for a new power house for the Fall River Electric Light Company on Hathaway Street; also for an annex to the Hartwell Street plant.

EAST BRAINTREE, MASS.—Braintree electric light department is considering installing a new unit for the station consisting of a 250-kw, 2,200-volt, 60-cycle, two-phase engine and generator. W. P. Mercer is superintendent.

STOUGHTON, MASS.—The citizens have voted to appropriate the sum of $4,700 for electric lights to be left to the direction of the selectmen. It was understood that some of the new lamps are to be placed at North Stoughton.

MILFORD, MASS.—The Milford Selectmen have contracted with the Milford Electric Light & Power Company to furnish 58 electric arc lamps for one year, the number now in use, for $5,000 a year. This makes the price per light per year $86.57. The price previously was $91.58.

MAYNARD, MASS.—The residents of South Acton have petitioned the American Woolen Company to furnish electricity for lighting the town, and as the proposition is agreeable to the company it is likely that before long wires will be extended to South Acton and the town lighted by power furnished at the Maynard Mills.

WESTBORO, MASS.—At a recent special town meeting, Special Justice John W. Slattery, Richard F. Parker and Melvin H. Walker were appointed to investigate the question of municipal lighting. This committee has visited a number of towns in the country where municipal lighting is being tried, and was to report at the adjourned March meeting, but did not have its report ready.

WESTBORO, MASS.—The contract of the Westboro Gas & Electric Company for lighting the town expires May 1, but the company is desirous of having the contract continue for another year and has so petitioned the Selectmen. The company proposes to accept the $3,360 appropriated at the annual meeting for the exact number of lamps in use at present, additional lights to be charged for at the prevailing rates.

PITTSFIELD, MASS.—P. H. Dolan, manager of the Pittsfield Street Railway, has closed a contract with the D. M. Dillon Boiler Works, of Fitchburg, for five new 200-hp boilers for the proposed new power house on Seymour Street. The contract calls for the brick and masonry work and setting them in place in the new house at a cost of about $10,000. The contract for the erection of the power house will be awarded in a few days.

AMESBURY, MASS.—At a recent meeting of the Amesbury Electric Light Committee, it was decided to make extensive improvements both in buildings and in machinery, and $30,000 will be expended in modernizing the whole plant. An addition will be put on the present power house so as to bring the electrical machinery all on one floor. Not only will the house be modernized, but the machinery as well. Superintendent H. A. Sawyer, B. F. Sargent and Mr. Mather will take up this work of enlargement and improvement.

VICKSBURG, MICH.—The Warner arc lamps are being installed in the municipal electric light plant. B. R. Platt is village clerk.

LAPEER, MICH.—F. J. Schlegel writes that it is proposed to construct an electric light plant in Lapeer at a cost of $15,000.

HOLLY, MICH.—The Holly Electric Light & Power Company is dissolved and out of business, and the plant is for sale. There is some possibility of the city purchasing the plant. Chas. H. S. Poole is manager.

IRON MOUNTAIN, MICH.—The city clerk writes that the matter of constructing an electric light plant will probably be brought before Council within the next two months.

GRAND RAPIDS, MICH.—The Boyne City Electric Company will build a new power dam over Boyne River during the present year to furnish light and power for Boyne City. M. W. Swift is superintendent.

DETROIT, MICH.—Promoters using the name of Attorney Frank D. Andrus have made application to the Common Council for a 30-year franchise for a complete street railway system, embracing some 200 miles of track. The company is known as the People's Railway Company.

MANCELONA, MICH.—The Mancelona Electric Light & Power Company will buy power from the Antrim Light & Power Company at Mancelona and change its system to alternating-current during the summer. The power company will soon commence operations to develop its water power plant on Cedar River, seven miles west of Mancelona and expects to have power in the city by November, 1906. Fred Wildi is manager.

RUSH CITY, MINN.—Rush City Electric Light Company contemplates changing from flat rate to meters. C. M. Johnson is manager.

ELBOW LAKE, MINN.—Elbow Lake Electric Light Station is installing a 66x18 high-pressure boiler. Geo. Arenson is superintendent.

BELLE PLAINE, MINN.—It is reported that bids will be received until May 1 by J. E. Townsend, borough clerk, for a 15 to 20-year franchise for a light plant.

EVELETH, MINN.—The Spruce and Adam mine of Eveleth will install a 100-kw 250-volt machine to drive the new locomotive that goes in the four hundred foot level of the Spruce No. 1.

EVELETH, MINN.—The Eveleth Electric Company will light the city water works at St. Marys Lake, a distance of three miles, and will pick up business on the way. S. S. Hough is manager.

EVELETH, MINN.—The Oliver Iron Mining Company is installing a 400-kw 250-volt generator, direct-connected at its No. 4 Fayal shaft. Most of this power will be used for lighting underground workings and driving its 18 electric locomotives.

BEMIDJI, MINN.—A. A. Warfield, of Bemidji, secretary Beltram Electric Light & Power Company, writes that it is proposed to install an 800-kw hydro-electric light plant some time this fall. About $50,000 will be expended.

LAKE CITY, MINN.—Lake City Electric Light & Water Works has changed from direct current to alternating current in the past year, and has installed a 250-hp Reeves engine, 150-kw Fort Wayne alternator, also a 30-kw Westinghouse alternator. The company will install a new boiler this summer and seven alternating current arc lamps. E. V. Lombard is superintendent.

BROOKHAVEN, MISS.—At a meeting of the Mayor and Board of Aldermen a petition was granted by H. Cassidy, J. W. McGrath, George C. Haskins, W. H. Sevey and E. E. Becker, asking that they be granted a franchise to construct and operate a street railway in Brookhaven. Action in the matter was deferred until the May meeting.

KANSAS CITY, MO.—The South Side Electric Light & Power Company offers for sale a franchise in this city not being used at present. H. C. Pfeiffer is president.

ST. LOUIS, MO.—The North American Company, which controls the United Railways Company, the Laclede Gas Company and the Union Electric Light & Power Company, is negotiating for the purchase of the St. Louis & Suburban Company.

SEDALIA, MO.—The Railway & Electric Company has taken possession of the street railway lines, power house and electric light plant, of this city, which were formerly operated under lease by the Sedalia Transit Company. The Railway & Electric Company will make improvements at once.

PENDER, NEB.—M. W. Murray, Village Clerk, writes that the citizens voted on April 3 to issue $10,000 bonds for an electric light plant.

OMAHA, NEB.—Herman Weise has been awarded the contract for the new building for the new telephone exchange at South Omaha, which will cost $26,000.

HUMBOLDT, NEB.—Humboldt electric light plant will install a 100-kw machine soon and will then start a day power circuit. It also expects to install a 200-hp engine this year. Address M. A. Williamson.

NEBRASKA CITY, NEB.—The Water & Light Company writes that it does not contemplate any changes this season as the city may purchase the plant, both water and light. B. P. Egan is manager.

ELY, NEV.—C. D. Vail, of Butte, Mont., is making preliminary surveys and estimates for the Ely Townsite Company, with a view to constructing water works and an electric light plant at Ely.

PATERSON, N. J.—The State Legislature has passed a bill enabling Paterson and Passaic to own and operate municipal electric lighting plants.

NEW BRUNSWICK, N. J.—The bill passed by the State Senate may enable this city to construct a municipal electric light plant.

BORDENTOWN, N. J.—The Bordentown Electric Light & Motor Company has secured the contract for lighting the city for five years at $90 per year for arc lamps and $18 per year for incandescent lamps.

ORANGE, N. J.—The Common Council has rejected the bid of the Public Service Corporation, recently received, for lighting the city, the bid being considered excessive. It is reported that if lower figures are not received, a municipal electric light plant will probably be constructed.

NEWARK, N. J.—The Board of Trade on April 11 passed a resolution in favor of the establishment of a municipal electric light plant, and recommended that the Mayor and Common Council employ experts to investigate and report not later than December 1 on the probable cost of the installation of such a plant.

NEWARK, N. J.—Bids will be received until April 26 by the Committee on Buildings of the Board of Chosen Freeholders, of which Hugh Gallagher is chairman for light fixtures in the Essex County Isolation Hospital. Herman Kreitler is the architect and John F. Capen, associate, 45 Clinton Street, Newark.

ROCKAWAY, N. J.—A petition is in circulation asking the Mayor and Council to call a special election to vote on bonding the borough to buy the electric plant of the Rockaway Electric Light & Improvement Company. The petition will be presented at the regular meeting of the Council on April 26. S. B. Libby is superintendent.

CORTLAND, N. Y.—The Cortland County Traction Company is planning to extend its line to Preble.

SANDY HILL, N. Y.—The Union Bag & Paper Company is contemplating an addition to its Baker's Falls power house so as to install a fourth generator.

PIKE, N. Y.—T. H. Couler, Village Clerk, writes that the village will not construct a municipal electric light plant, but will award the lighting contract to the Genesee Valley Power Company.

ROCHESTER, N. Y.—Eastern Monroe Electric Light & Gas Company is installing a 150-kw, three-phase, 4,400-volt Westinghouse revolving field generator. Geo. L. Colgate is consulting engineer.

ROCKVILLE CENTRE, N. Y.—The board of trustees of the municipal electric light plant proposes to separate street lighting from the commercial lighting during the coming summer. Geo. W. Rowe is village clerk.

CORTLAND, N. Y.—The Cortland Home Telephone Company has voted to spend $20,000 in improvements on its system.

EAST HAMPTON, N. Y.—East Hampton Electric Light Company is changing its plant from one to two-phase system and is laying about 10,000 feet of underground cable in addition to about six miles now in use. Geo. R. Eldredge is manager.

FULTON, N. Y.—L. W. Emerick, vice-president of the Fulton Light, Heat & Power Company, writes that plans are now being prepared for improvements, to include water wheels, governor, generator, switchboard, boilers and a smoke stack.

WATERTOWN, N. Y.—Work is progressing satisfactorily on J. B. Taylor's electric power enterprise at Black River. It is expected the plant when completed will develop a minimum of 2,200 horse-power. If not...ng unforseen occurs, the construction work at Black River will be completed by July and wires or cables for power transmission will be placed to connect that village with Watertown by September.

WESTCHESTER, N. Y.—The Directors of the Westchester Lighting Company have elected Dr. B. W. Stillwell, of Yonkers, as vice-president of the company, and Mr. Stillwell has become the executive officer of the corporation. Francis A. Stratton, who retired from the active duties as president, was chosen chairman of the Executive Committee. Mr. Still well will be in charge of the general offices. He has been the treasurer of the company in the past. H. A. Carter will now act as secretary an treasurer.

SPENCERPORT, N. Y.—At a recent meeting of the stockholders of the Hilton Telephone Company, held in the village building at Hilton, it was voted not to sell the plant to the Bell Telephone Company, but to increase the amount of the capital stock from $8,000 to $15,000. At a meeting of the directors held immediately after the stockholders' meeting, the president and manager, John E. Cooper, was given the power to enlarge the plant and extend the lines as he thought advisable. An additional switchboard and other improvements will be added to the central office, and active operations will soon be begun on the construction of new lines and the extension of others.

GREENSBORO, N. C.—The Carolina Electrical Company, backed by Philadelphia capital, has secured a franchise from High Point to Thomasville.

CHARLOTTE, N. C.—The Charlotte Consolidated Construction Company of this city has been examining the latest patterns of gas engines with the view, it is said, of installing two large gas engines for driving electric generators.

MANCHESTER, OHIO.—The city is constructing an electric lighting plant. John K. Dunbar is clerk.

PAINESVILLE, Ohio.—The City Council is considering the establishment of a municipal lighting plant.

SANDUSKY, OHIO.—The Sandusky Gas & Electric Company is installing two 250-hp Aultman and Taylor water tube boilers.

PORTSMOUTH, OHIO.—The Portsmouth Street Railroad & Light Company has increased its capital from $125,000 to $500,000.

OXFORD, OHIO.—The Board of Public Affairs contemplates adding to the municipal electric light plant three new boilers this summer. S. H. Allen is clerk.

ALLIANCE OHIO.—The Sandy Valley Telephone & Electric Company has been incorporated with a capital of $50,000. The incorporators are R. S. Kayler and others.

SPRINGFIELD, OHIO.—It is stated that the Springfield, Troy & Piqua Traction Company is planning to build an extension from Troy to Greenville, Ohio, a distance of 30 miles.

BLUFFTON, OHIO.—William Plattner, superintendent, writes that extensions and improvements are to be made on the municipal electric light and water works plant this summer.

ELYRIA, OHIO.—The Elyria Milling & Power Company writes that it is proposed to enlarge its plant by the installation of a larger water wheel and dynamos for electrical power.

AKRON, OHIO.—The Akron Bell Telephone Company is preparing to make important improvements to its system. A new switchboard and 67,500 feet of new cable will be installed.

COLUMBUS, OHIO.—The Ohio Legislature has passed favorably on an appropriation of $25,000 for the purpose of installing an electric lighting system in the State capitol at Columbus.

SIDNEY, OHIO.—The Sidney Electric Light Company is using Westinghouse three-cylinder gas engines in place of steam engines with good success and economy. F. D. Elwell is superintendent.

HAMILTON, OHIO.—The Hamilton Home Telephone Company has made application to the City Council of Middletown for a franchise to establish an exchange and lay conduits in that place.

LISBON, OHIO.—The New Lisbon Gas Company has just added a new 30-kw generator and gas engine to take care of day current, and also putting in a number of motors and fans. N. Way is manager.

MANSFIELD, OHIO.—The Mansfield Railway, Light & Power Company is applying for a franchise from the city to build a loop around Central Park in the business section; also to lay a second track on Main Street.

URBANA, OHIO.—The city will soon place a contract for city lighting. A measure has been introduced in the council providing that the city shall not pay more than $7,500 for lighting the streets and public buildings of the city.

BOWLING GREEN, OHIO.—The Lake Erie, Bowling Green & Napoleon Railway Company is preparing to extend its line about 7 miles west of Bowling Green to a point on the Maumee River where a summer resort will be located.

FOSTORIA, OHIO.—The people of this city will be given an opportunity to vote on the question of issuing bonds not to exceed $50,000 for the purpose of installing an electric lighting plant in connection with the water works.

CLEVELAND, OHIO.—J. T. Ross, chief engineer of the Everett-Moore construction forces, has completed a survey from Sandusky to Clyde for the Lake Shore Electric Railway and is now making a survey from Sandusky to Fremont.

LORAIN, OHIO.—The Citizens Gas & Electric Company is planning to make extensive improvements to its Lorain plant this year. The company will purchase a new engine and a generator and will install a number of new lamps.

TOLEDO, OHIO.—The Toledo Railways & Light Company has been awarded the contract for illuminating the Government buildings here. The Toledo Gas, Electric & Heating Company, recently incorporated, also submitted a proposition.

LIMA, OHIO.—The Columbus & Lake Michigan Railroad has been purchased by the Widener-Elkins Syndicate for a consideration of $675,000. The portion now operated by steam will be electrified at once, and may be extended to Bryan, Ohio.

MT. STERLING, OHIO.—The municipal electric light and water plant will install new boilers and new lamps for street lighting and other improvements during the summer to the amount of about $7,000. H. Clay Johnson is clerk of the board.

SUMMERFIELD, OHIO.—The Noble County Telephone Company and the Stranathan & Milley Telephone Company have sold their interests to the Home Telephone Company of Cambridge. Important improvements will be made to the systems.

CINCINNATI, OHIO.—The directors of the Cincinnati Gas & Electric Company have authorized President N. G. Keenan to secure 6,000 additional hp of boilers for the electric lighting power plant. A large amount of wire in the central portion of the city is to be placed underground. The improvements will cost about $300,000.

CLEVELAND, OHIO.—Attorney John N. Stockwell, representing the Cleveland Light & Power Company, has made an informal application to Mayor Johnson for an electric light franchise. The attorney promised that if the franchise is granted a provision would be included in the ordinance whereby the city can take over the plant at its discretion.

CLEVELAND, OHIO.—The Cleveland Light & Power Company has

made application to the City Council for a franchise enabling it to supply light and power in all parts of the city. The company promises cheaper lights for the city and private citizens and a plan for ultimate municipal ownership of the plant. Some years ago the company secured a franchise to furnish current in a certain portion of the downtown district, and it claims to be furnishing 90 per cent of the electric light now used in this district. Mayor Johnson wants the company to agree to build a large power station on the lake or river front where power could be produced economically, before he will agree to support the company's project.

MARIETTA, OHIO.—The Parkersburg & Ohio Valley Traction Company has secured all the right of way from Sistersville to Waverly, W. Va., and is said to be securing right of way from Waverly to Parkersburg. Ultimately it is the intention to connect Parkersburg with Wheeling, W. Va.

CLEVELAND, OHIO.—It is stated that the financial matters for the proposed Cleveland, Ashland & Mansfield Railway have been adjusted, and that within the next two weeks the Roberts & Abbott Company, of this city, engineer for the property, will place the contracts for construction and material.

SPRINGFIELD, OHIO.—Officials of the Schoepf syndicate, which recently purchased the Appleyard lines, state that plans are being made for extensive improvements to the main power station at Medway near this city. It is stated that additional machinery will be installed and another sub-station erected.

TOLEDO, OHIO.—The Everett-Moore Syndicate, which owns the Maumee Valley Railway & Light Company and its extension known as the Toledo, Waterville & Southern Railway, is said to be investigating the advisability of extending the latter line from its present terminus at Waterville on to Whitehouse, Colton and Napoleon.

EAST LIVERPOOL, OHIO.—Thomas Bracken, of New York, is negotiating for the purchase of valuable coal lands near West Point. He proposes to establish a large power station to supply electricity to East Liverpool, Youngstown, Miles, Warren, Cleveland and other points within 100 miles. He is a mechanical engineer and represents New York capitalists.

OKLAHOMA CITY, OKLA.—N. S. Sherman, of this city, was recently awarded the contract for the construction of electric plant and water works at Wynnewood, I. T.

SHAWNEE, OKLA.—Shawnee Lighting Company has purchased and is installing a 500-kw steam turbine and two railway generators of 575-kw capacity. U. S. Hart is chief clerk.

READING, PA.—The Pennsylvania Telephone Company is preparing to do a great deal of work in this district this spring and summer.

MUNCY, PA.—Muncy Electric Light, Heat & Power Company contemplates installing a 150-hp Olds gas producer and engine. F. R. Bussler is chief engineer and electrician.

ETNA, PA.—The borough has just installed a 100-light Wood arc generator in the municipal electric light plant and completed its light circuits with Wood arc lamps. A. R. Dunbar is borough clerk.

PITTSBURG, PA.—The charter of the Fording-Morse Syndicate of Pittsburg for the construction of a subway in the down-town section of Pittsburg, has been approved by Governor Pennypacker.

PORT CARBON, PA.—Port Carbon Electric Light, Heat & Power Company has been leased to and is operated by the Edison Electric Illuminating Company of Pottsville. Isaiah Cartwright is secretary.

WILKESBARRE, PA.—An ordinance has been introduced in the Council giving the Midway Connecting Company the privilege of entering the city and constructing a railroad from its terminus at the corner of Merchants Alley and North Pennsylvania Avenue to Nanticoke.

HUMMELSTOWN, PA.—The Hummelstown electric plant has been purchased by the proprietors of the Hummelstown water plant and will be improved and continuous service will be given as soon as larger dynamo and new water wheels are installed. E. H. Leffler is manager.

ERIE, PA.—Additions to the present extensive equipment costing more than $50,000 are in progress at the plant of the Edison Electric Light & Power Company, corner of Twelfth and French Streets. A 1,500-hp engine of the vertical type will be put in place. A traveling crane with a lifting power of 20 tons will also be added to the equipment of the plant.

HAWLEY, PA.—V. A. Decker, E. C. White and Lewis P. Cooke have purchased the plant of the Hawley Electric Light Company and have organized the Paupack Electric Company. They will rebuild the plant, putting in new and additional water wheels, boilers and generators. F. C. White is president; Lewis P. Cooke, vice-president, and V. A Decker, secretary and treasurer.

ALLENTOWN, PA.—At a recent meeting of the directors of the Consolidated Telephone Companies of Pennsylvania, a lease of three telephone companies for 999 years was effected. The companies in this consolidation are the Easton & Bethlehem, the Warren and the United States Long Distance Telephone Companies operating at Bethlehem, Easton, Phillipsburg and Alpha, N. J., and in the surrounding territory in Northampton and Bucks Counties of Pennsylvania, and Warren Counties, New Jersey. The leased companies have 250 miles of wire and fifty miles of cables, with more than 1,000 subscribers.

BAKER CITY, ORE.—The City Council has granted H. H. Andrews a franchise for a power system in Baker City.

BAKER CITY, ORE.—The Oregon Electric Power Company has applied for a 30-year franchise for supplying electricity for lighting purposes in this city.

SALEM, ORE.—The Citizens Light & Traction Company has decided to expend about $50,000 in enlarging the power station and reconstructing and extending its lines. R. Welsh is chief engineer.

PORTLAND, ORE.—The Pence Company has made application to the County Court for a 25-year franchise to build a double-track railway on the Portland-St. Helena wagon road from Portland to Lewiston.

PORTLAND, ORE.—An electric railway will be built from Seaside to Cannon Beach, in the vicinity of Arch Cape, a distance of about 15 miles. J. E. Simmons, of Portland, who promoted the Oregon & Pacific Coast Railway Company, is behind the project.

PORTLAND, ORE.—C. W. Miller, manager of the Mt. Hood Electric Company, writes that bids for construction will be received on May 2 at Portland. The initial installation will cost $300,000. Engineers, Bates & Clark, Seattle, Wash.

SALEM, ORE.—The Portland General Electric Company, which recently purchased the Citizens' Light & Traction Company of Salem, will increase the generating capacity of the Salem plant by 600 hp. Plans have been perfected for transmitting power at 60,000 volts from the hydro-electric plant at Oregon City for the Willamette Traction Company, to furnish light and power to the towns along the latter company's line.

SAUNDERSTOWN, R. I.—The Wickford Light & Water Company will establish an electric lighting system at this city.

PROVIDENCE, R. I.—The Legislature has granted permission to the Worcester & Providence Street Railway Company to increase its capital stock to a sum not exceeding $2,000,000.

WESTERLY, R. I.—The Board of Directors of the Westerly Automatic Telephone Company has voted to issue $20,000 capital stock. Of this amount $10,000 is reserved for the present subscribers, if taken and paid for between April 11 and May 10.

PROVIDENCE, R. I.—The New England Shaver Telephone Company has petitioned the Legislature for an amendment to its act of incorporation, to change its name to the Home Telephone Company, of Rhode Island, to increase is capital stock to $2,500,000, and to issue from time to time its first mortgage bonds not exceeding $1,500,000.

BAMBERG, S. C.—The Electric Supply Company, of Savannah, Ga., has the contract for the construction of an electric light plant.

COLUMBIA, S. C.—Surveyors have completed over 30 miles of the line of the proposed route of the electric line from Columbia to Augusta, Ga., via Aiken, there being a line already in operation between Aiken and the Georgia city.

ABERDEEN, S. D.—F. W. Raymond, City Auditor, writes that the citizens voted on April 6 to issue $85,000 bonds for constructing a municipal electric light and power plant.

KNOXVILLE, TENN.—The Knoxville Railway & Light Company will probably ask the city for a contract to place 75-cp incandescent electric lamps in the place of the gas lamps for which the contract has been hanging fire for the last three months.

NASHVILLE, TENN.—The Board of Public Works has awarded several contracts for equipment of the light department. Among the contracts awarded were to the Braid Electric Company and John A. Roebling Sons Company for furnishing collectively copper and rubber covered wire. The Southern Electric Company was given the contract for furnishing 5,000 glass insulators.

ALVIN, TEX.—The Council has granted Henry Wamble a franchise to construct an electric light and power plant.

BROWNSVILLE, TEX.—F. J. Combe and S. C. Tucker, of Brownsville, are interested in the construction of an electric light plant here.

EAGLE LAKE, TEX.—The Eagle Lake Manufacturing Company will be in the market for a 75 or 80-kw generator this season. E. J. Scott is manager.

HARRIMAN, TEX.—The city is about to install a new 150-kw generator and 60 new street lamps in the city electric light system. J. B. Bodwell is city clerk.

CORPUS CHRISTI, TEX.—Randolph Robertson says that the Corpus Christi Street Railroad Company will construct a line from Aransas Pass Depot, a distance of 4½ miles.

DALHART, TEX.—Dalhart Ice & Electric Company is now installing a 40-kw, 110-volt direct-current dynamo for day use on a fan and power circuit. W. H. Wolff is manager.

AUSTIN, TEX.—The charter of the Northwestern Toll Line Company of Dallas has been filed. The company has a capital of $25,000. The incorporators are A. A. Miller, A. A. Marrs and W. Weaver.

WAXAHACHIE, TEX.—The Waxahachie Gas & Electric Company contemplates installing a 160-hp steam engine in its plant this summer. This will take the place of a 100-hp Armington & Sims engine. Thomas Cook is superintendent.

TEMPLE, TEX.—J. C. Houser has taken steps towards building an interurban electric railway between this city and Marlin, a distance of about 25 miles. Helland & Werenskoild, of Dallas, Tex., have charge of the survey of the route for the proposed route.

GALVESTON, TEX.—J. H. Hill, general manager of the Galveston, Houston & Henderson Railroad, has been directed by the board of directors of that road to investigate the substitution of electricity for steam as motive power on the line. The road runs between Galveston and Houston, a distance of 51 miles.

EL PASO, TEX.—T. B. Enochs, of Kansas City, Mo., is at the head of a syndicate which proposes to build an electric railway from the coal fields in the Caballero Mountains to Clint, passing through El Paso. The proposed road will be about 60 miles long. Judge M. W. Stanton, of this city, is the local representative of the syndicate.

HOUSTON, TEX.—Harvey T. D. Wilson, of Houston, is promoting an electric railway to connect the city with its principal suburbs. A number of St. Louis (Mo.) capitalists have been interested in the project and an application will soon be made to the City Council for a franchise. The proposed system will comprise about 15 miles of track.

HOUSTON, TEX.—G. E. Tripp, of Boston, Mass., representing the Stone-Webster syndicate, who has been making an inspection of the street railway systems owned by that corporation, states that it has been determined to expend about $500,000 in improving and extending the Houston electric lines. The capacity of the power house is to be increased in addition to other improvements.

FORT WORTH, TEX.—J. A. Murray, manager of the Texas lines of the Texas Long Distance Telephone Company, and J. C. Casler, manager of the independent exchange here, together with parties at Weatherford, have organized a home company at Weatherford and will incorporate with a capital stock of $50,000. They will spend $25,000 improving the Weatherford exchange, and will have long-distance connection with the independent exchange here.

AMERICAN FORK, UTAH.—C. W. Earl, of American Fork, has filed an application in the State Engineer's office for permission to divert water from the American Fork Canyon for power purposes.

MORRISVILLE, VT.—The citizens of Morrisville have voted to construct a municipal electric plant. A dam will be built across the Lamoille River at Cady's Falls, at a cost of $44,000. There is a possibility that the Mt. Mansfield Electric Railroad, which runs between Waterbury and Stowe, may be extended to Morrisville.

SUFFOLK, VA.—A company is seeking a franchise for an electric railway over the streets of the town.

NORFOLK, VA.—The Norfolk Railway & Light Company is building a new electric railway from Ocean View to Sewall's Point.

INDEPENDENCE, VA.—The Independence Electric Light & Milling Company have decided to construct an electric light plant and roller mill.

ALEXANDRIA, VA.—Alexandria municipal electric light plant needs new equipment, but the city has not the funds to purchase it. The city will sell the plant if it can get a fair bid. J. B. Waller is city clerk.

STAUNTON, VA.—The Blue Ridge Light & Power Company is enlarging and improving its plant. In addition to the large new alternating-current generator recently installed, two new boilers have arrived, and the machinery is being placed, and will soon be in operation, when the plant will be able to furnish all the power necessary for the street cars and for lighting purposes for a long time to come.

BREMERTON, WASH.—The question of establishing a municipal lighting plant is under consideration.

PASCO, WASH.—Dr. N. Fred Essig, of Spokane, has petitioned for a franchise for water works and an electric light plant in Pasco.

TACOMA, WASH.—The Home Automatic Telephone Company will build a three-story building. The structure will cost $75,000.

SEATTLE, WASH.—Another unit (5,500 hp) will be added to the municipal lighting plant as soon as the $600,000 bond issue is sold. This announcement is made by members of the Council and by Superintendent Youngs, of the light and water department.

MARBLEMOUNT, WASH.—W. A. C. Rowse, of Mt. Vernon, Wash., president of the Cascade Valley Railway Company, writes that it is proposed to construct an electric railway from Marblemount to Horse Shoe Basin, a distance of about 25 miles. The cost is estimated at $1,000,000.

WALLA WALLA, WASH.—The Columbia & Walla Walla Traction Company is making a survey of its proposed electric railway from Walla Walla to Clarkston, under the direction of C. E. Sears. The company has elected the following officers: Miles C. Moore, president, of Walla Walla; John H. Morrow, of Waitsburg, first vice-president and general manager; M. R. Hanger, of Dayton, second vice-president; Frank W. Paine, of Walla Walla, treasurer; C. C. Gose, of Walla Walla, secretary.

MORGANTOWN, W. VA.—The South Morgantown Street Railway Company has been given a franchise by the City Council.

PLYMOUTH, WIS.—The Plymouth City Water Works intend installing a new boiler during the coming summer. P. J. Douglas is superintendent.

GREEN BAY, WIS.—The Brown County Telephone Company will increase its capital stock from $10,000 to $20,000, and make considerable extensions to its lines.

GREENWOOD, B. C.—The West Kootenay Power & Light Company has purchased a site in Anaconda from B. C. Smith on which will be erected a plant to supply this town with light and power.

SUPERIOR, WIS.—S. M. White, city engineer, writes that the citizens voted April 3 to purchase the plant of the Superior Water, Light & Power Company or build municipal water works and electric light plant.

MILWAUKEE, WIS.—A franchise has been granted to the West Shore Telephone & Telegraph Company, and they will begin at once the construction of a $3,000,000 system in this city, which will also connect with independent lines throughout the State.

NELSON, B. C.—Efforts are being made to finance an electric railway to open up Duncan Valley. Address John L. Retallack, Kalso, B. C.

LADNER, B. C.—The British Columbia Electric Railway Company is considering the extension of the electric lighting system to Ladner this year. R. H. Sperling, of Vancouver, is manager.

GREENWOOD, B. C.—The Greenwood Electric Company has a proposition before the Council to light the town and expects to erect a large power plant at Boundary Falls, B. C., for supplying towns in southern British Columbia with light and power.

NEW WESTMINSTER, B. C.—H. M. Burwell, representing the Burrard Flume Company has received permission to appropriate 25,000 inches of water from Lillooet River. The company proposes locating a power plant at a point where Kanaka Creek runs into Fraser River a short distance above Port Haney. The plan is to have the water brought from Lillooet Lake in a flume.

WEYBURN, CAN.—The City Council has approved the plans for a municipal electric lighting plant to cost $50,000. Address J. A. Wood, Mayor.

CALGARY, CAN.—The Council has voted $30,000 for the purpose of doubling the capacity of the civic electric light plant. Address J. Emerson, Mayor.

SASKATOON, CAN.—The Saskatchewan Telephone & Electrical Supply Company will increase its telephone system here by 300 lines and will generally improve the service.

PINCHER CREEK, CAN.—The Pass Electric Railroad Company has applied to the Alberta Legislature for permission to build an electric railway from here to Crow's Nest Lake, a distance of about 36 miles.

SASKATOON, CAN.—A. Turner city secretary and treasurer, writes that bids will be received on April 24 for the construction of an electric light plant and for sewerage and drainage systems. Engineer, Willis Chipman, of Toronto, Ont.

PINCHER CREEK, CAN.—The Crow's Nest & Prairie Electric Railroad has applied to the Alberta Legislature for powers to build an electric railway from Pincher Creek to the western end of Crow's Nest Lake, a distance of about 43 miles.

WINNIPEG, MAN.—The Council has decided to add two units to the civic electric light plant at a cost of $16,100. Address F. E. Cambridge, city electrician, or Alderman Gibson.

BRANDON, MAN.—The Kensington-Brandon Land & Development Company has made application to the city for a charter to build an electric railway in this city. Address Mayor Fleming.

NEW LISKEARD, ONT.—The Council has decided to install a civic lighting plant. Address the mayor.

STRATHROY, ONT.—The Council has decided to spend $5,000 on improvements to the municipal electric light plant.

LONDON, ONT.—The London Electric Street Railroad Company has decided to erect an addition to its power plant at a cost of $75,000.

MORRISBURGH, ONT.—William Bermingham, Ottawa, Ont., has the contract for developing the 1,100-hp electrical plant here. Cost, $73,000.

BOBCAYGEON, ONT.—The town will install an electric lighting plant which will be operated under municipal ownership. Address the mayor.

PARRY SOUND, ONT.—Work will be commenced at once on the new municipal electric lighting plant here. Simpson & Lewis, engineers, of Ottawa, Ont., have charge of the work.

THESSALON, ONT.—Corporation light and water system which is now running on a flat rate will install meters and adopt the meter rate this summer. E. F. Thompson is chief engineer.

GODERICH, ONT.—H. von Schon, of Detroit, Mich., is engineer for the proposed power plant to be constructed on Maitland River for the Maitland River Power Company, the cost of which is estimated at $250,000.

FORT WILLIAM, ONT.—The town will build a new telephone exchange which will be equipped with a 17-section switchboard with a capacity of 5,000 lines. The building will be completed by August 1. Address Superintendent Jones.

WELLAND, ONT.—Welland Electric Light Company is contemplating installing a distributing station for power, which is generated at De Cew Falls, Ont, 9½ miles distant. When this is done the company will discard the present local plant. F. W. Houston is superintendent.

TORONTO, ONT.—The Toronto & Hamilton Electric Railway Company has applied at Ottawa for permission to change its name to the Toronto, Niagara & Western Railway Company, to extend its line as far as Windsor, to increase its capital stock, and to lease its right of way to power companies..

PETERBOROUGH, ONT.—Otonabee Power Company, Ltd., plant comprises five-mile transmission from dam to sub-station, 1,500-kw, three-phase, 60-cycle generator, 6,600 volts transformed at sub-station to 2,300 lighting secondary 110 to 220-volt. It is all Canadian General Electrical apparatus.

HAMILTON, ONT.—The Hamilton, Galt & Guelph Railroad Company is applying for powers to build a line from Hamilton to Elmira, passing through Galt, Preston, Berlin and Waterloo, a distance of 56 miles; also for powers to build a line from Hamilton to Elora and Fergus, a distance of 40 miles.

BURLEIGH FALLS, ONT.—J. Alex. Culverwell, managing director of the Central Ontario Power Company states that work will be commenced on the power plant on May 1. The main line will pass through Peterborough, Millbrook, Bowmanville and Oshawa, the latter two places having applied for 1,800 hp each. A branch line will be run from a point north of Millbrook to Omemee and Lindsay. The falls have a capacity of 7,000 hp which the company will develop.

THETFORD, QUE.—The people have passed a by-law granting the necessary privileges to the Shawinigan Water & Power Company to enable it to distribute light and power in the municipality.

LONGUEUIL, QUE.—The Council of this town has granted the Longueuil Tramways Company an exclusive franchise for thirty years. It is the intention of the company to commence building as soon as ground is ready for the rails. The company will operate through the town and extend through the county of Chambly.

SANTA CRUZ DE BRAVO, MEX.—An electric light and power plant is to be installed at Santa Cruz de Bravo by the Federal Government.

MERIDA, MEX.—The American Gas Company has purchased the electric light and power plant at Merida. The price paid was $1,600,000.

MANZANILLO, MEX.—The representative of an American syndicate is said to have been investigating the situation in this vicinity with a view to building an electric railway.

EL DUERO, MEX.—The Guanajuato Electric Light & Power Company is preparing to extend its electric transmission lines to the towns of Ocotlan, Jemay and Ribera Castellanes. This is an American company which operates a large hydro-electric plant at El Duero. It is already furnishing lights and power to Guanajuato, Leon, Irapuato and La Barca.

CHILPANCINGO, MEX.—R. H. Springer, of Chicago, is said to be at the head of a party of engineers who are making a survey for a proposed electric railway from Chilpancingo to some point on the Balsas River. It is stated that a syndicate of Chicago capitalists is back of the project and that all preliminary arrangements have been made for the construction of the road.

MAZATLAN, MEX.—The machinery for the large hydro-electric plant which is to be installed on the Piaxtla River by the owners of the Guadalupe de los Reyes mines has arrived at the site of the proposed plant. The hydro-electric plant will have a capacity of 5,000 hp and will cost about $800,000. Robert McDoble, an electrical engineer of San Francisco, Cal., has charge of the construction work.

ZAMORA, MEX.—The Government of the State of Michoacan has granted a concession to an American company to install a large hydro-electric plant for the purpose of supplying the towns of Zamora, Puruandiren and La Piedad Cabadas with electric lights and power. The work of constructing the dam is now in progress and the necessary machinery for the plant has been ordered in the United States.

Company Elections.

GREENFIELD, IND.—The Carrolton Telephone Company has elected Charles Dalrymple, C. P. Davis, Julian Strahl, Charles Vetters and Edward Allen, directors.

ANDERSON, IND.—At the annual meeting of the directors of the Indiana Union Traction Company, held in Philadelphia, the following officers were elected: A. W. Brady, president; George H. McCulloch, chairman board of directors; C. Levering Jones, first vice-president; W. Kelsey Schoepf, second vice-president; D. G. Edwards, third vice-president; Messrs. Brady, Jones, Schoepf, Morgan and Kingston, executive committee.

VINCENNES, IND.—The annual meeting of the Vincennes Light & Power Company, of Vincennes, Ind., resulted in the election of this board: Edward M. Deane, Dwight Smith, Benjamin P. Merrick and Harry B. Wales, of Grand Rapids; Henry W. Frund, J. W. Emison, J. L. Bayard, Jr., R. E. Purcell, W. H. Vollmer and Charles Bierhaus, of Vincennes. Reports showed the past year with the company to have been a most prosperous one, with the outlook for this year's business bringing a gratifying improvement over that of the past.

GOLDFIELD, IA.—At a recent meeting of the board of directors of the Goldfield Telephone Company, W. V. Palmer was elected manager for the ensuing year, to take the place of L. A. McIntyre, who recently resigned. The company contemplates increasing the capital stock from $10,000 to $20,000. As soon as the weather will permit the company will commence the construction of new rural lines from this city in all directions where the field is not already covered.

FREDERICK, MD.—At the annual meeting of the stockholders of the Frederick County Telephone & Telegraph Company, the following directors were elected: Dr. P. D. Fahrney, Dr. F. B. Smith, D. T. Ordeman, C. D. Walker, G. M. Besant, Chas. C. Carty and James H. Harris.

BOSTON, MASS.—At the annual meeting of the Philadelphia Electric Company the retiring board of directors was re-elected.

MANKATO, MINN.—The directors of the Citizens' Telephone Company, at its recent regular meeting, organized by re-electing all of the present officers, as follows: Dr. J. H. James, president; H. A. Patterson, vice-president; W. D. Willard, secretary and treasurer; W. A. Funk, attorney. The company is considering the extension of its lines into the farming districts.

SPEISER, NEB.—The Speiser Rural Telephone Company held its annual meeting and elected the following officers: C. Lionberger, president; R. F. Conrad, secretary.

OMAHA, NEB.—A meeting of stockholders of the Omaha Electric Light & Power Company was held at Bangor, Me., March 29. The following directors were elected: S. Z. Mitchell, C. N. Mason, E. R. Coffin, H. W. Yates, E. W. Hart, Guy C. Barton, Casper E. Yost, G. W. Holdrege and F. A. Nash. The former officers will probably be re-elected, with the exception of G. E. Clafflin, who will be succeeded as vice-president by H. W. Yates.

WEST UNITY, OHIO.—The West Unity Electric Light Company has elected its officers: A. M. Miller, president; J. A. Hollington, vice-president; L. P. Charpiot, secretary-treasurer. The company is planning to build an electric light plant in this village.

CINCINNATI, OHIO.—The Cincinnati Light, Heat & Power Company, the recently incorporated company which is to apply for a franchise to supply electricity to users in this city, has been formally organized. The officers are as follows: H. H. Bechtel, president; C. W. Cole, secretary-treasurer; these, with Cyrus E. Mead, E. R. Stearns and G. W. Mallon, are directors.

SALEM, ORE.—A recent meeting of the directors of the Citizens' Light & Traction Company, held for reorganizing the property, the following named officers were elected: President, H. W. Goode; vice-president, F. G. Sykes; secretary and treasurer, Sam G. Reed; manager, Rollin K. Page, all of Portland. Mr. Page has moved to Salem and will take charge of the railway, light, power and gas systems of Salem and the electric plants at Woodburn, Mount Angel and Silverton.

JACKSON, TENN.—At a stockholders' meeting of the Jackson Suburban & Street Railway the following were elected directors for the ensuing year: J. L. Wisdom, Sr., J. H. Hirsch, S. E. Wilson, Hunter Wilson, Thomas Polk, G. S. Wilkerson and T. J. Murray. S. E. Wilson was elected president of the board; J. H. Hirsch, vice-president; Hunter Wilson, manager and attorney; John Wisdom, Jr., superintendent; G. C. Wilkerson, secretary, and Thomas Polk, treasurer.

New Industrial Companies.

THE ELECTRIC CONSTRUCTION SUPPLY COMPANY, of Springfield, Ohio, has been incorporated with a $10,000 capital stock, by William Rodgers and others.

THE GARRETT TROLLEY WHEEL COMPANY, Garrett, Ind., has been incorporated to establish a plant and manufacture trolley wheels. John B. Mager, John Trapp and Adam Trapp are the incorporators.

THE WARREN J. GREEN ELECTRICAL SUPPLY COMPANY has been formed at Watertown, N. Y., to furnish electrical supplies and equipment, and to do electrical work of every description.

THE MANHATTAN ELECTRICAL RANGE COMPANY, of New York, has filed application for articles of incorporation with a capital of $30,000, and the following directors: Maurice Bayne, O. H. Seaman, New York.

THE SAFETY ELECTRIC VALVE COMPANY, of Brooklyn, N. Y., has been incorporated with a capital of $20,000. The directors are Edward Schrenkeisen, M. J. Kane, New York; E. H. Vogel, Brooklyn.

THE MARKLE ELECTRIC COMPANY, of Terre Haute, Ind., has been incorporated. The company will manufacture electrical devices and supplies. The incorporators are R. M. Markle, E. L. Cooper and G. R. Fields.

THE AMERICAN HORTUNG BATTERY COMPANY, of Jersey City, N. J., has been granted incorporation papers. The capital is $500,000. The incorporators are Gustave K. Hortung, George H. Fagan and A. M. Lynch.

New Incorporations.

JUNCTION CITY, ARK.—The Junction City Light & Water Company has been incorporated with a capitalization of $10,000. R. G. Brown is president, and W. V. Brown and D. K. Brown, directors.

SAN DIEGO, CAL.—Articles of incorporation of the Los Angeles & San Diego Beach Railway Company, capitalized at $6,000,000, with $165,000 actually subscribed, have been filed. The directors are E. S. Babcock, A. E. Babcock, A. B. Talbot, A. E. Lillicrap and James Stroup.

DENVER, COL..—S. S. Large, Fred W. Bailey and H. D. Allen have filed articles of incorporation in the office of the Secretary of State for the Denver Municipal Traction Company. The capitalization is $100,000, and the company's charter is for 20 years. Messrs. Large, Bailey and Allen form the board of directors for the first year.

HARRINGTON, DEL.—The Peall-Klier Company has been incorporated to install a system of electricity at Harrington also to construct a factory for the manufacture of ice.

MILLSTADT, ILL.—Millstadt Telephone Company, with a capital of $1,200, has been incorporated by F. W. Kreshner and others.

TAMAROA, ILL.—Tamaroa Telephone Company, with a capital of $2,500, has been incorporated by C. O. Winthrop, C. R. Rice, J. T. Marlow.

CHICAGO, ILL.—The Osmium Light Company has been incorporated with a capital of $25,000. The incorporators are Robert H. Izer and others.

OAKLAND, ILL.—Embarrass Telephone & Telegraph Company, with a capital of $45,000, has been incorporated by H. H. Knipe, E. N. Blair and J. D. Noel.

GALESBURG, ILL.—The Home Light & Power Company has been incorporated with a capital of $150,000. The incorporators are E. P. Robson, Harry Gardt and I. S. Callender.

VILLA GROVE, ILL.—The Villa Grove Electric Company has been incorporated with a capital of $6,000. The company will operate an electric light and water plant. The incorporators are: V. H. Elmore, E. C. Elmore and C. W. Hageman.

GOODLAND, KAN.—The Goodland Light, Heat & Power Company has been chartered with $50,000 capital. The company proposes to build an electric light plant at this place. Denver capitalists are backing the enterprise.

PARSONS, KAN.—J. A. Plotner, of Kansas City, and others, have taken out a charter under the New Jersey laws for the incorporation of the Prairie Telephone Company, with a capital of $200,000, and headquarters at this city.

CHANUTE, KAN.—The Southeastern Kansas Railway, Light & Power Company has been organized and capitalized at $4,000,000. The incorporators are L. Rosenthal, J. J. Jones, Frank Dixon and R. C. Rawlings, of Chanute, and J. W. Stephens, of New Orleans. The offices and power plant will be located in Chanute. The plans provide for the construction of 160 miles of track. As soon as this line is completed, extensions will be built from Galena to Webb City and Carthage and from Chanute to Coffeyville.

AUGUSTA, ME.—The Lake View Traction Company has been organized for the purpose of doing a general business in transportation, amusement, real estate, electrical, telegraph, telephone, etc., with a $50,000 capital stock, of which nothing is paid in as yet. I. L. Fairbanks, of Augusta, is president and treasurer of the new company.

JACKSON, MICH.—Articles of association have been filed by the Grass Lake & Sharon Telephone Company. The capital is $1,000, and the directors are W. G. Alber, John Lemm and Ashley L. Holden. The office is at Grass Lake.

HAGERSTOWN, MD.—A company has been formed of Cumberland Valley capitalists to build an electric railway from Greencastle to Mercersburg, about 15 miles. The following are the officers: T. M. Nelson, president; George B. Beaver, first vice-president; A. N. Pomeroy, second vice-president; H. B. McNulty, secretary; Joseph Sierer, treasurer. The company is capitalized at $500,000.

NELSON, MINN.—The Nelson Telephone Company has been incorporated with a capital of $10,000.

BELTRAM, MINN.—The Beltram Electric Light & Power Company has been incorporated, with a capital of $50,000, by W. G. Schroeder, W. C. Warfield and others.

MINNEAPOLIS, MINN.—The Mississippi River Power Company, recently incorporated with $50,000 capital, is planning to generate 12,000 hp by dams at Clearwater and Monticello, for transmission of electric energy for sale in the twin cities.

AKELEY, MINN.—The Akeley Telephone Company has been incorporated with a capital of $15,000. The incorporators are H. H. Thomas, Amos Thomas, H. H. Johnson, Robert Dulin, H. I. Davis, L. M. Thomas, Jorgen Laugen, C. R. Flink, Bert Rodman, Edward Darrow.

ATKINSON, NEB.—The Citizens' Telephone Company has filed articles of incorporation with the Secretary of State. The company will operate an independent telephone exchange in this city.

WAYNE, NEB.—The Wilbur Telephone Company has been incorporated. The capital stock is $2,800, and the incorporators are W. H. Bueton, F. M. Griffith, A. Grier, Ferdinand Thim and John Harder.

DOUGLAS, NEB.—The Solon Telephone Company has filed articles of incorporation with the Secretary of State. The principal place of business of the new concern is Douglas, Otoe County, and the capital stock is $25,000. The incorporators are George B. Hendricks, A. M. Malone and twenty-one others.

JAMESTOWN, N. D.—The Jamestown Traction Company has been incorporated with a capital of $150,000. The incorporators are Morris Beck and others.

MASSAPEQUA, N. Y.—The Massapequa Gas, Electric Light & Power Company has been incorporated with a capital of $50,000. The incorporators are J. S. Lily and others.

HANNIBAL, N. Y.—The Hannibal Telephone Company has been incorporated with a capital of $5,000, and the following directors: John McFarland, C. A. Cox and M. H. Miner, Hannibal.

NEVERSINK, N. Y.—The Neversink River Telephone Company has been incorporated with a capital of $7,000. The incorporators are Lee V. Gardner and Ernest W. Kinne, Centerville Station, N. Y.; Leo G. Laidlaw, Hurleyville, N. Y., and others.

BROOKLYN, N. Y.—The Independent League Railway Company is to be incorporated to build a double-track electric railway from Brooklyn Bridge to Coney Island, with a branch to Williamsburg. The preliminary capital is to be $150,000. Among those interested in the movement are: Charles T. Hartzheimer, Bela Tokaji, Michael F. Flaherty, Alfred J. Boulton and William H. Boyes, all of Brooklyn.

PENN YAN, N. Y.—The certificate of incorporation of the Hause Hill Telephone Company has been filed with Henry T. Read, County Clerk. The directors for the first year are as follows: William Paulding, Frank Ellison, Ernst Sproul, Martin J. Howell, Mott Honeywell, Adriam Babcock and George Faucett, all of Dundee. The capital stock of the corporation is $2,500. The main office of the company is in Dundee.

HIGH POINT, N. C.—The North Carolina Electric Company, of High Point, has been incorporated with a capital of $1,000,000 to generate electricity for power, light and heat; also to construct and operate a railway. Weirlle C. Hard, of Philadelphia, Pa., is one of the incorporators.

HAMERSVILLE, OHIO.—The Home Telephone Company has been incorporated with a capital of $10,000. The incorporators are Harvey McCall and others.

CLEVELAND, OHIO.—The Northern Light Company has filed articles of incorporation with a capital of $10,000. The incorporators are Fred Desberg and others.

COLUMBUS GROVE, OHIO.—The Columbus Grove Farmers' Mutual Telephone Company has been formed with S. M. Keirns, president; Samuel Williams, secretary, and E. A. Fancher, treasurer.

YOUNGSTOWN, OHIO.—The Wheatland Street Railway Company and the West Middlesex Street Railway Company have been incorporated by Randall Montgomery, M. C. McCaskey, W. T. Burns and S. C. Rodgers, of Youngstown, and Charles Beckman, of Sharon.

NEWKIRK, OKLA.—A charter has been granted the Newkirk Commercial Mutual Telephone Company, with a capital stock of $12,000. The incorporators are C. A. Johnson, H. M. Ziegler and associates.

SHAWNEE, OKLA.—The Shawnee Gas & Electric Company has been incorporated, with $75,000 capital stock. The incorporators are: F. P. Stearns, of Shawnee; T. W. Odell, of Oshkosh, Wis.; Sinclair Mainland, of Green Bay, Wis.

MOUNTAIN PARK, OKLA.—The Mountain Park Telephone Company, of Mountain Park, has been incorporated with a capital stock of $5,000. The incorporators are W. W. Watson, C. E. Jecks, D. A. Giles, T. C. Gessner and J. C. Watson.

PROVOLT, ORE.—Applegate Valley Telephone Company has been incorporated with a capital stock of $1,000. The incorporators are E. Badger, E. N. Provolt and Charles Meserve.

PENDLETON, ORE.—A telephone company has been organized at Milton for the purpose of building a line from the town into the country. The capital is $5,000. The organizers are C. E. Simonds, William Forsythe and J. B. Saylor.

ALBION, PA.—The Albion Light & Power Company has been incorporated with a capital of $5,000.

BETHEL, PA.—Bethel Street Railway Company, with a capital of $75,000, has been incorporated with S. L. Tone, of Pittsburg, president.

LIGONIER, PA.—Ligonier Street Railway Company has been incorporated with a capital of $60,000. J. Williams, of Allegheny, is president.

EBENSBURG, PA.—The Ebensburg & Black Lick Light, Heat, Fuel & Power Company has filed articles of incorporation with a capital of $5,000.

HARRISBURG, PA.—St. Clair & Sodom Street Railway Company has been incorporated, with a capital of $28,000. President, S. L. Tone, of Pittsburg.

NORTH EAST, PA.—The North East Heat & Light Company has been incorporated with a capital of $24,000. The incorporators are E. J. Evans and others.

MOSCOW, PA.—Pocono Mountain Telephone Company has been incorporated with a capital of $10,000, by R. J. Tanfield, of Valeville, Lackawanna County.

HARRISBURG, PA.—Uniontown & Masontown Street Railway Company has been incorporated with a capital of $72,000. P. F. McCool, of Butler, is president.

DUNBAR, PA.—The Dunbar Water Supply Company and the Dunbar Electrical Company have been incorporated with a capital of $5,000 each and with the same directors as follows: Wm. W. Fitzmiller, Jas. McMullen, John N. Shimer and others, all of Philadelphia.

PITTSTON, PA.—The Pittston Light, Heat & Power Company has been incorporated with a capital of $150,000 to furnish light, heat and power in Pennsylvania. Directors: J. Rutledge, Pittston, and Frank P. Slattery and John Flanagan, both of Wilkesbarre. This company recently secured a contract to light the city of Pittston for five years.

PROVIDENCE, R. I.—The Legislature has granted to William Segar, Jones Pendleton, R. W. Perkins, H. W. Gallup and E. W. Jackson a charter incorporating them as the Westerly & Connecticut Railway Company, with a capital stock not exceeding $400,000 with a place of business in the town of Westerly, R. I.

ABILENE, TEX.—The Abilene Light & Water Company, of Abilene, has been incorporated with a capital of $200,000 by W. G. Swenson, Abdon Holt and George S. Browne.

MALLARD, TEX.—The Mallard Telephone Company, of Mallard, has been incorporated with a capital stock of $8,600. Incorporators are J. D. and G. L. Parr and J. H. Golightly.

HUBBARD CITY, TEX.—The Union Central Light & Ice Company has been incorporated with a capital of $35,000. The incorporators and officers are W. August Bass, president and manager; J. E. Waller, first vice-president; J. M. Carroll, second vice-president; Hon. W. E. Spell, attorney, and Allen & Scott, of Waco, are the architects and supervising engineers.

SOUTH RYEGATE, VT.—The Boltonville Falls Electric Company has been organized with the following charter members: M. F. Sargent, R. Farquharson, F. J. Tewksbury, Geo. H. Roben, Jas. Craigie, H. W. Goodine and Chas. Taplin.

BLACKSBURG, VA.—The Blacksburg Power & Supply Company has been incorporated, with a capital of $50,000, by D. H. Keister, J. L. Eakin and others, all of Blacksburg.

BIG STONE GAP, VA.—The Cumberland Traction Company has been chartered with a capital of $10,000 which may be increased to $25,000 later. J. S. Wright is secretary and treasurer.

TENINO, WASH.—The Tenino Light & Water Company has been incorporated with a capital of $10,000.

OLYMPIA, WASH.—The Washington Electric Railway & Power Company has filed articles of incorporation with the Secretary of State, showing a capital stock of $1,000,000. The incorporators are James R. Wood, of Portland, E. C. Peets, O. J. Smith, C. Guler, C. W. Moore and A. E. Frost.

BARABOO, WIS.—Farmers' Mutual Telephone Company has filed articles of incorporation, with a capital of $6,000. The incorporators are Robert Attride and others.

KAUKAUNA, WIS.—The Kaukauna Gas Electric Light & Power Company has been incorporated with a capital of $100,000 to make improvements to the electric light plant. A. R. Coates is interested.

STRATHCONA, CAN.—The Strathcona Radial Tramway Company is applying to the Alberta Legislature for incorporation. Address F. C. Jamieson, secretary and treasurer.

WINNIPEG, MAN.—The James Ballantyne Company has been incorporated here with a capital of $50,000 to establish and operate steam, gas, electric lighting and heating plants. The directors are J. Ballantyne, A. W. P. Buchanan, Montreal; G. A. Young, Hamilton, Ont.

ST. JOHN, N. B.—The Maritime Light & Power Company has been incorporated here with a capital of $100,000 to operate light and heat systems and manufacture apparatus for lighting and heating purposes. The directors are J. R. L. Starr, J. H. Starr, J. H. Spence, A. Rogers, all of Toronto, Ont.

INGERSOLL, ONT.—The Ingersoll Independent Telephone Company has been organized.

HAMILTON, ONT.—The Hamilton, Galt & Guelph Railway is seeking incorporation for the purpose of constructing an electric railway from Hamilton to Elmira.

OTTAWA, ONT.—The Frontenac Gas Light & Power Company will ask Parliament for power to manufacture gas and electricity in the Quebec District. It has a capital of $1,000,000.

MOOSEJAW, SASK., ONT.—The Moosejaw & Suburban Rapid Transit Company is applying for incorporation with powers to build telephone lines along the route of its electric railway lines.

LOW BANK, ONT.—The Low Bank Telephone Company has been incorporated with a capital of $40,000 to build and operate telephone lines in this town. The directors are A. Barrick, J. E. Furry, A. Mann, Haldimand County, Ont.

WELLAND, ONT.—The Falls Power Company has been incorporated with a capital of $10,000 to manufacture electricity, gas, etc., for lighting and heating purposes. The directors are G. C. Brown, D. Ross, J. E. Cohoe, Welland, Ont.

DELHI, ONT.—The Delhi Light & Power Company has been incorporated here to manufacture gas and electricity for light and heat. The capital is placed at $40,000 and the directors are P. Quance, S. Strout, E. Morgan, all of Delhi.

TORONTO, ONT.—The Central Oil & Gas Company has been incorporated here with a capital of $40,000 to manufacture gas, oil and electricity for lighting purposes. The directors are J. S. Lovell, W. Bain, E. W. McNeill, all of Toronto.

COBALT, ONT.—The Long Lake Power Company has been incorporated here with a capital of $100,000 to carry on a general business as an electric power company. The directors are S. White, Windsor, Ont.; T. P. Watson, New Liskeard, Ont.; and H. C. Barber, Cobalt, Ont.

Legal.

STEAM TURBINE LITIGATION.—The Westinghouse Machine Company has begun a third suit against the Allis-Chalmers Company in which infringement of another Westinghouse-Parsons steam turbine patent is alleged. The bill was filed in the Circuit Court for the District of New Jersey. The patent sued on is No. 783,830, owned by the Westinghouse Machine Company. This patent covers the construction of the rotating element of the turbine as used by the Westinghouse Machine Company and the Allis-Chalmers Company. The suit was filed on April 11.

SUIT AS TO NUISANCE.—The Court of Appeals of New York has ruled against the defendant in the suit of Miller versus the New York Edison Company. Plaintiff sued to restrain a nuisance and for damages caused by the maintenance of an electric light and power plant by defendant on adjoining premises. The evidence showed that after the plant had been erected plaintiff had made a lease of its premises for a term of years, and at the expiration of such term the lease had been renewed, and that at the expiration of the second term they were again leased to the same tenant for lower rent. The court found that no injury was done plaintiff's premises by the electric plant at the time of the trial, and there was no probability that any injury would result in the future; that, though the rent to be paid under the last lease was less than that in the other leases, there was nothing to show that the difference was caused by defendant's acts; and that the only injury which had been caused by the plant was to the occupation of plaintiff's premises, and was not of a permanent character. It was held on appeal that plaintiff could not recover for any depreciation in the rental value pending the lease, as the tenant was alone entitled to recover for any such injury. This decision reversed that of the lower court.

SHOCK FROM TELEPHONE WIRE.—The Kansas City Court of Appeals has reversed a decision for plaintiff, for injury received, in Politowitz versus Citizens' Telephone Company. It was alleged that defendant carelessly and negligently constructed, maintained and operated its wires, in that they were not properly insulated and protected, that the attachments and fastenings were defective, that the wires sagged down, that they were made of poor and rotten material, and that they broke and fell across the street. The court directed the jury to find for plaintiff, if defendant carelessly and negligently permitted its wires to fall and lay down on the streets. It was held that the instruction was erroneous, in that it authorized a recovery if the wires fell upon the ground from any negligent cause, instead of confining the jury to a consideration of the negligence charged in the petition. Where a company maintaining electric wires in streets is negligent in the construction and maintenance of its wires, and in permitting them to sag down and fall on the street, it is liable for injuries caused to a person coming in contact with the wires, regardless of whether it has notice that the wires are down. Where the particulars constituting negligence are pleaded, plaintiff is limited to prove the particular negligent acts alleged, notwithstanding a general charge of negligence.

INJURY FROM LIVE WIRE.—The Supreme Court of Montana, in the appeal of Bourke versus Butte Electric & Power Co. has sustained the verdict of $20,000 for the plaintiff. It was held that defendants' electric light wire, by which the plaintiff was injured, was strung on and along a public street and over a tramway trestle leading to a mine, built at right angles with the wire, the plaintiff was injured by coming in contact with the wire while working on the trestle as an employe of the owner of the mine; and that, in the absence of anything to justify the conclusion that either the owner of the wire or the owner of the trestle was a trespasser as to the other, an instruction imposing on defendants the duty of inspecting their lines of wire was not objectionable, on the ground that plaintiff was a trespasser as to whom defendants owed no duty of inspection. It was also held that the owner or operator of an electric plant is bound to exercise reasonable care in selecting appliances and insulating wires, wherever people have a right to go and are liable to come in contact with them, and in maintaining a system of inspection by which any change in the physical condition of such apparatus which would tend to increase the danger to persons lawfully in the pursuit of their business or pleasure may be reasonably discovered. The plaintiff had been earning $3.50 per day and was 45 years old; and it was stated that he will never be able to work again for a living.

INJURY TO LINEMAN.—The Circuit Court of the Western District of Pennsylvania has held that only reasonable care is required from a company as to its appliances, machinery, etc., the case being that of a lineman injured on duty. The plaintiff, who was in the employ of the defendant telephone company (Central District Printing & Telegraph Co.) as cable splicer, was sent by a superior in the daytime to locate and repair an injury to the cable sheathing which had been reported. He climbed a pole which stood at a place where the street curved and between two lines of electric light wire, the outer one of which had been fastened on a bracket to the telephone pole to hold it from swinging against such pole and wires. This wire had become detached from the insulator and had dropped against the pole, and was in contact with a guy wire, and plaintiff, taking hold of such guy wire, received a shock which caused him to fall, and he was injured. The displacement of the light wire could not be observed from the ground, and the placing of the pole between the light wires and the manner in which the light wire was fastened to the same were shown to have been usual and customary. Held, that defendant was not chargeable with negligence, either because of such mode of construction or for failing to discover the dangerous condition of the wire, which could not have been done by the usual methods of inspection. Held, further, that plaintiff was guilty of negligence contributing to his injury in failing to see and avoid the danger after he had climbed to the place of contact of the two wires. A master is bound to the exercise of only reasonable care with respect to machinery, appliances or places to work, and the measure of such care is that ordinarily exercised by others in the same business.

Obituary.

MR. L. BANNISTER.—We note with deep regret the death at the Hotel Imperial in this city, on Saturday, April 14, of Mr. Lemuel Bannister, for many years vice-president of the Westinghouse Electric & Manufacturing Company. Mr. Bannister was born in a small town in northern New York in 1841. He was educated in the public schools. His first business ventures were in the lumber trade and for many years he was connected with R. DeWees Wood in that business in Philadelphia. In 1888 he went to Pittsburg and became connected with the Westinghouse Fuel, Gas and Manufacturing Co., as general manager. Then he went into the electrical business, becoming connected with the Westinghouse Electrical & Manufacturing Company. After a time he gave special attention to the European business, to take charge of which he left America ten years ago. He built the electric railways in Berlin and other European cities. He was a member of the Lawyers and Engineers

Clubs of New York and the Duquesne Club of Pittsburg. Eight months ago Mr. Bannister was taken ill in Europe with a cancerous affection of the throat. He got worse and came to New York two weeks ago. His wife, Frances Kenyon Bannister, survives him.

Personal.

MR. THOMAS HALL.

MR. THOMAS HALL.—The veteran electrical inventor and manufacturer, Mr. Thomas Hall, celebrates in Cincinnati this week his eightieth birthday. He was born at Norwich, England, April 20, 1826, and at the age of two was brought to America by his father, who settled in Boston. After attending public school there he went to work for Mr. Daniel Davis in 1839, succeeding him in 1850 under the firm name of Palmer & Hall. Shortly after that he bought out his partner and styled the firm Thomas Hall, manufacturing electrician. From 1860 to 1898 he was located at 19 Bromfield Street, when he gave up business. At the time when Mr. Hall was apprenticed to Daniel Davis, the latter was the only electrical instrument maker in the United States. They made the first telegraph instruments for Morse in 1844, and afterwards built sounders, keys, registers, etc. Mr. Hall was one of the first men in this country to teach telegraphy. At this period of his life he invented the double adjustable relay, lightning arresters, railway signals, magnetos and an automatic safety gate, several of these appliances being still produced. In 1850 he built and operated a model electric motor car taking current from the rail, and exhibited this at the Massachusetts Charitable Mechanics' Association in Faneuil Hall, Boston. In 1860 he exhibited a car called Volta. In 1867 he invented the Hall life raft and other electrical apparatus, which was followed by the electric stop on ruling machines and the electric valve used in creameries to keep milk at an even temperature for separation. Another device was the electric recorder for noting at the pumping station the height of water or of gas at the reservoir. The result of all this work was to bring him a large number of gold, silver and bronze medals in this country, as well as a medal from the Paris Exposition of 1867 for his railway signal. Such work, however, being largely experimental, was also costly and Mr. Hall was never able to derive any large pecuniary reward from his inventions, although they brought him the acquaintance of all the leaders in the electrical and scientific field throughout the country. The portrait reproduced herewith was taken some years ago, but is a fair representation of Mr. Hall at the present time, hale and hearty and full of interesting reminiscences of pioneer electrical days in America. His son, Mr. W. A. Hall, with whom he is living in Cincinnati, is well known in the electrical field and has a great deal of his father's inventive skill.

MR. R. P. BOLTON, consulting mechanical engineer, will remove his offices May 1 to the Night & Day Bank, Fifth Avenue, New York.

MR. GEORGE A. ILER has succeeded Mr. J. Minick as electrical engineer for the Davis Coal & Coke Company, of Thomas, W. Va.

MR. V. RAY RONK, auditor of the Detroit, Monroe & Toledo Short Line, has resigned to become manager of the electric lighting and heating plant at Bowling Green, Ohio.

MR. GEORGE WESTINGHOUSE, JR., sailed last week for Europe, where various important matters await his attention. It is expected he will return some time in July.

MR. FRANCIS W. JONES, chief electrical engineer of the Postal Telegraph Cable Company, has returned to New York after a trip of about a month in the south and west, chiefly on engineering work.

MR. T. A. EDISON has returned with his family to Orange, N. J., after his usual winter vacation on his Florida plantation. He is in much improved health and has resumed active work at the laboratory.

MR. N. D. MACDONALD, of the Electrical Testing Laboratories, New York City, has been spending his time this month at the Locke and Thomas insulator factories, inspecting and testing high-tension insulators for several transmission plants in the west.

LOUIS J. AUERBACHER has resigned his position as engineer for Shoenberg & Co., and has organized The Beck Flaming Lamp Co., of which he is president. Mr. Auerbacher sailed for Europe April 21st to study the flaming arc lamp industry on the other side.

COL. R. C. CLOWRY, president and general manager of the Western Union Telegraph Company, sails this week for Europe, accompanied by his wife and by Mr. H. D. Estabrook, the solicitor of the company. He will be absent about six weeks touring England and the Continent.

MR. LAWRENCE W. CADY, formerly designing engineer in the electric heating department of the General Electric Company, has severed his connection with that corporation and has accepted the position of designing engineer for the Simplex Electric Heating Company of Cambridge, Mass.

MR. HARRY T. REITER, manager of the Fremont Street Railway Company, of Fremont, Ohio, has resigned to become manager of the Fort Worth & Arlington Heights Interurban Railway Company, of Fort Worth, Tex., operating the electric light and water works plants and the street railway system.

MR. JOHN A. BRITTON, president of the Pacific Gas & Electric Company, of San Francisco, Cal., sailed on the Pacific Mail Liner Siberia, April 7, for a three-months' pleasure trip in China and Japan. Mr. Britton has had charge of the recent consolidation of the properties of the California Gas & Electric Corporation and the San Francisco Gas & Electric Company, and is now taking a well-earned rest.

GENERAL EUGENE GRIFFIN, first vice-president of the General Electric Company, sailed from New York on April 10, on the steamer "Graf Waldesee." General Griffin plans an extended trip in England and on the Continent, largely for rest and recreation. As he is a director in the Cie Francaise Thomson-Houston and vice-chairman of the British Thomson-Houston Company, these interests will naturally claim a portion of his time.

MR. J. RAWLE.—Mr. James Rawle, secretary and treasurer of the J. G. Brill Company, has been elected president of that company, succeeding the late G. Martin Brill. Mr. Rawle is a civil engineer by profession, and was for some time in the service of the Pennsylvania Railroad Company. He entered the old firm of J. G. Brill & Son in 1872, and ever since that time has been conspicuous in car building and in steam and electric railway development.

MR. C. L. EDGAR, president of the Boston Electric Company, who has been under a good deal of strain lately through the long and fatal illness of his father, has gone South for two or three weeks to recuperate. On his return he will sail for Europe to take up his duties as a member of the municipal ownership commission of the National Civic Federation. Several municipal plants on the other side are now under investigation by the commission and Mr. Edgar's expert aid is desired.

LORD RAYLEIGH.—A dispatch from London says: "That a scientist who is also a peer can at the same time be a good business man is proved in the case of Lord Rayleigh. Lord Rayleigh is one of the greatest scientists of the day. He was Senior Wrangler and Professor of Experimental Physics at Cambridge; is a Professor of Natural Philosophy and has innumerable decorations and scholarships. In addition he is a good business man. He owns a large estate, Terling Place, near Witham, Essex, and this he has converted into a huge dairy farm from which he supplies the three stores he runs in London under the name of "Lord Rayleigh's Dairies." His profits from this source are very large. Lord Rayleigh is a brother-in-law of the Hon. A. J. Balfour and is staying with him at Carlton Gardens in the house which Ambassador Choate once occupied. Lord Rayleigh married Miss Evelyn Balfour, a sister of the former premier."

WESTINGHOUSE MACHINE PERSONNEL.—On account of the rapid expansion of the business of the Westinghouse Machine Company, the board of directors has decided to enlarge the executive organization by increasing the number of vice-presidents from two to four, and has elected Mr. E. H. Sniffin and Mr. Arthur West to fill the new offices of third and fourth vice-president respectively. Mr. Sniffin will be in charge of the sales department as heretofore, his field of work not being altered in assuming the new title. Mr. West, who has been chief engineer of the company, still retains that title and position. Mr. William A. Bole, in consequence of his election to the vice-presidency of the Westinghouse Foundry Company, has resigned as manager of works of The Westinghouse Machine Company in order that he may better serve the interests of the Foundry Company, of which he assumes the entire management. The Westinghouse Machine Company, however, retains Mr. Bole as consulting engineer, availing itself of his services and counsel on important work, which his ripe experience has made peculiarly valuable. Mr. Henry L. Barton, formerly general superintendent of the East Pittsburg Works of the Westinghouse Machine Company, has been appointed manager of works.

News of the Trade.

ANDERSON LINE MATERIAL.—Albert & J. M. Anderson Mfg. Co., Boston, has appointed Mr. T. C. White, 416 Market Street, St. Louis, sales agent for Anderson line material at that point.

BULLOCK & GOODWIN, electrical contractors, of 4 Mason Street, Biddeford, Me., would like to receive catalogues, discount sheets and bulletins from Eastern electrical supply houses.

THE PARAGON INSULATING COMPANY, of Cleveland, Ohio, is preparing to remove its plant to Findlay, Ohio, where a new plant is being erected. The company manufactures all kinds of insulating products from the by-products of the National Refining Company with which concern it will be associated in Findlay.

SIERRA Y. FERNANDEZ is the name of a new firm formed by M. J. Sierra and A. Fernandez at Ortega 11, City of Mexico, for the purpose of carrying on a business in electrical apparatus, machinery and installations in general. Their letter gives good references to public officials and others. They invite correspondence.

THE NATIONAL CARBON COMPANY, Cleveland, O., has for some time operated gas engines of different makes up to 200 hp in its various factories. It is now installing in its works at Clarksburg, W. Va., a 600 b.h.p. Koerting gas engine supplied by the De La Vergne Machine Company, of New York. The engine will be used for general power purposes and will operate on natural gas.

THE PELTON WATER WHEEL COMPANY, San Francisco, Cal., has recently increased its pipe works in the East and is now prepared to turn

out sheet-steel riveted pipe of any length, diameter or thickness, having exceptional facilities for the manufacture of this class of pipe, as well as the highest grade lap-welded pipe in all diameters and thicknesses for high-duty hydraulic work in connection with power developments.

COAL AND IRON BANK.—At a meeting of the stockholders of the Coal & Iron National Bank of the City of New York, held April 3, 1906, it was voted to increase the capital stock to $500,000 by the issuance of 20,000 additional shares. This, together with accumulated earnings, will make a total capital and surplus of $1,000,000. The action was taken to accommodate the increased and growing business of the bank.

THE MARINE ENGINE & MACHINE COMPANY has been awarded the elevator contract for the new "Brunswick site building," at 26th Street, Broadway and Fifth Avenue, convering eleven electric elevators. The building is to be twelve stories high and used as a high-class office building instead of a hotel as originally intended. The builder is Mr. Charles T. Wills, 156 Fifth Avenue, and the architect is Mr. Francis H. Kimball, 71 Broadway, New York.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY for Manhattan Borough has moved its erecting department from offices in the Trinity Building to the Fuller Building, corner of 23rd Street and Broadway. This change was made necessary because the department was in want of more space than it was possible to obtain at 111 Broadway, and also because the uptown location is more suitable and convenient for the construction work, most of the power plants being located within easy reaching distance.

HODGE-WALSH COMPANY, of Kansas City, Mo., has adopted the new firm style of Hodge Electric & Manufacturing Company, with headquarters at 701 Delaware Street, that city. Its efforts hereafter will be to push the sale of telephone apparatus and electrical supplies. The engineering department will be continued however. On account of the rapid increase in the jobbing department during the last two or three years, the firm has found it necessary to increase largely its stock and force, in order to take proper care of that end of its business.

THE AMERICAN FENOFID BRAZING COMPANY, of Philadelphia, Pa., announces that on account of its having secured control of the Donnelly portable oil torch, the fenofid process of brazing castings is made available everywhere. The company is prepared to enter into negotiations with companies looking toward the acquirement of shop rights for this process in localities where territorial rights have not been granted. The practicability of this method of repairing broken castings is demonstrated by its successful use by the Philadelphia Rapid Transit Company, the Public Service Corporation of New Jersey, J. G. Brill Company and others.

GAS ENGINES.—A lively and widespread interest has been aroused among engineers of all classes by the gas engine's rapid advance to the front rank of efficient and reliable prime movers. Especially has this interest been attracted by the recent remarkable development of the large gas engine. Taking the Koerting engine alone, that being probably better known and more widely used than any other, we find that there are 157 Koerting 2-cycle gas engines aggregating 131,685 B.H.P. in operation or in course of construction at the present time. This engine is handled in America by the De La Vergne Machine Company, East 138th Street, New York City.

NEW INDUSTRIAL VARNISHES.—The electrical world will be interested to learn that the Standard Paint Company, whose headquarters are at 100 William Street, New York, and which has been for over twenty years manufacturers of the P & B electrical compounds, has just placed upon the market a new line of insulating varnishes. They are as follows: P & B baking varnishes, black and clear, oil-proof; P & B finishing varnish, black, oil-proof; P & B air-drying varnish, black; P & B core-plate varnish, baking, oil-proof; P & B core-plate varnish, air drying. Although these are called P & B, they are entirely different from the P & B compounds, and lack the odor peculiar to the latter. Full information can be obtained from the Standard Paint Company, sole manufacturer.

STURTEVANT BLOWERS AND ENGINES.—The prestige which a concern attains in a special line of manufacture is often likely to seriously overshadow its development in other lines. An interesting example is that of the B. F. Sturtevant Co., of Boston, Mass. It is undoubtedly known from one end of the country to the other as the pioneer in the manufacture of fan blowers and a "Sturtevant" blower can be found in almost every manufactory of reasonable size. But alongside of the development of the blower by this company has been a similarly progressive development of the high-speed engine in a great variety of designs and sizes ranging from 3 to 300 hp. Designed originally for direct attachment to fans, the use of these engines, because of their special qualifications, has broadened into a larger field—particularly the direct-connected driving of Sturtevant generators. This has brought the annual output up to fully 1,000 engines per year.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED APRIL 10, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

817,152. APPARATUS FOR NICKEL-PLATING; Jonas W. Aylsworth, East Orange, N. J. App. filed Sept. 17, 1904. In an apparatus for the plating of a continuous strip, the combination of a support, means for sustaining and moving a continuous strip relatively submerged, means for raising and lowering the support, and an occluding chamber carried by the support and normally partially submerged in the solution, substantially as set forth.

817,160. HEAT-COIL; Frank B. Cook, Chicago, Ill. App. filed Nov. 14, 1903. In a heat-coil, the combination of a hollow, heat-conducting element, heat-producing means, a conducting-pin inserted into the said element, fusible material securing the conducting-pin to the said element, and means whereby, when the fusible material is softened, the said pin is turned in the said element.

817,162. PROCESS OF TREATING ALKALINE STORAGE BATTERIES; Thomas A. Edison, Llewellyn Park, N. J. App. filed Sept. 29, 1904. The process of treating, prior to shipment, an alkaline storage battery, the negative mass of which contains when charged, finely-divided iron and metallic mercury, which consists in completely discharging the negative mass so as to fully oxidize the same and prevent atmospheric oxidation, substantially as and for the purposes set forth.

817,210. MAGNETIC FRICTION CLUTCH; Harry W. Williams, Akron, O. App. filed May 26, 1905. The friction surface is formed by an expansible ring which has a centrally projecting lever by which it is expanded. The lever engages an independently revoluble disc which can be gripped and held by magnets to operate the clutch under certain circumstances.

817,212. ELECTRIC FURNACE; Charles O. Wingren, Pasadena, Cal. App. filed Aug. 21, 1905. The combination of a metallic air-tight casing composed of a body portion and a removable cover secured thereto, said cover being provided with an upwardly-extending dome; electrodes insulated from and secured to said body; resistance material in said casing between said electrodes a crucible in said resistance material between said electrodes; heat-insulating material within said casing and surrounding said electrodes and crucible except at and near the dome; a viewing-pipe extending from the crucible, upward through the heat-insulating material and terminating the dome; and air-exhaust mechanism connected to said dome whereby the air may be exhausted from the crucible.

817,222. ELECTRIC SWITCH; Harold E. Case, Bridgeport, Conn. App. filed March 24, 1904. A knife blade switch in which the contacts are formed mainly of steel and brass for the purpose of economy. A leaf or blade of copper is, however, included to give proper conductivity.

817,232. REGULATION OF ELECTRIC CIRCUITS; Edgar A. Edwards, Cincinnati, O. App. filed March 7, 1902. The combination with a normally open constant-current circuit and a regulating-magnet in shunt thereto, of a differentially-wound dynamo for supplying current thereto, and means for automatically closing said circuit by current from the dynamo, substantially as described.

817,256. ELECTRIC SIGNALING FOR TROLLEY RAILROADS; Edward W. Lee, South Atlanta, Ga. App. filed Jan. 31, 1905. Details of trolley contact device for a signal circuit employing a wooden base or support with copper covered wooden strips thereon for engagement with the trolley wheel.

817,264. ELECTRIC CONTROLLING DEVICE FOR CARS; James H. K. McCollum, Toronto, Canada. App. filed March 1, 1905. A complete control system for cars having a magnetic brake and control circuits by which the various combinations are automatically effected.

817,281. AUTOMATIC INTERCOMMUNICATING TRAIN REPORTING SYSTEM; Elmer E. Steiner, Knightstown, Ind. App. filed July 14, 1905. The usual trolley pole carries an additional wheel or contact to engage a special signal wire.

817,290. ELECTRIC RAILWAY SWITCHING MECHANISM; Harry L. Young, Pueblo, Col. App. filed Oct. 5, 1905. Complete railroad switching system employing magnets at the switches which directly actuate the switch points and are energized by a special trolley connection which is provided at a proper point along the track.

817,293. AUTOMATIC RAILROAD SIGNAL; James S. Anderson, Ames, Neb. App. filed Dec. 26, 1905. The locomotive has a number of inclined frames fastened to it which constitute contact plates and engage with contact rollers supported adjacent to the track in order to complete the necessary signal circuits.

817,305. ELECTRIC METER; Thomas Duncan, Lafayette, Ind., App. filed June 6, 1904. The usual permanent magnet of a wattmeter is formed with a magnetic shunt, the reluctance of which can be varied to compensate for the decreasing strength of the magnet.

817,322. DISPLAY APPARATUS; Calvin Jackson, Reading, Pa. App. filed May 31, 1905. A whirligig having planetary parts. The rotation gives a novel effect from the colored incandescent lamps carried.

817,329. TERMINAL OR COUPLING FOR ELECTRIC CABLES; William and John Y. Middleton, Newcastle-upon-Tyne, England. App. filed June 5, 1905. A pair of notched discs have annular recesses in their opposed faces and are clamped together so that the cables lead out through the notched portions.

817,346. ELECTRIC HAND LAMP; Herman F. Stakelbeck, Philadelphia, Pa. App. filed Aug. 9, 1905. A two-part plug is received into the base of the lamp and serves to clamp the circuit wires in proper relation thereto.

817,348. TRACK INSTRUMENT FOR AUTOMATIC RAILWAY BLOCK SIGNALING; Alfred J. Stecker, Detroit, Mich. App. filed Mar. 27, 1905. Mechanical details of a circuit making tappet adjacent the track rails. A hinged blade is deflected to close one signal circuit when the train passes in one direction and an additional blade closes the second signal circuit when the train passes in the opposite direction.

817,366. ELECTRIC SWITCH FOR ELECTRIC RAILROAD CARS; Otto Frank and Peter J. McCaffrey, Brooklyn, N. Y. App. filed Apr. 1, 1905. A pair of magnetic valves control the respective inlets at the two ends of a pneumatic cylinder which moves the switch arm, and a pair of springs are disposed to normally hold the arm in central relation.

817,368. OVERHEAD TROLLEY SUPPORT AND SWITCH; Byron E. Green, Ilion, N. Y. App. filed Sept. 28, 1904. A metallic box or casting having means for the attachment of the usual trolley wires at a turn-out, and having grooves to guide the wheel on to the proper wire.

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817,390. PRIVACY DEVICE AND BUSY-SIGNAL FOR TELEPHONE APPARATUS AND SYSTEMS. Egbert A. Reynolds, New York, N. Y. App. filed Aug. 19, 1904. In a telephone system, the combination with a generator and a conductor arranged to conduct therewith, of a plurality of telephone instruments, each provided with a switch for connecting same in talking-circuit with the conductor and having a common return to said generator, of a privacy device for each instrument including an electromagnet arranged in a normally open branch in series with said talking-switch, said branch, when closed, also constituting a return-path from the said switch to the generator, and means for momentarily closing and then opening the branch of any one instrument prior to the closing of the talking-switch thereof, whereby circuit will only be completed through the privacy branch of one instrument and the talking-switch of another instrument.

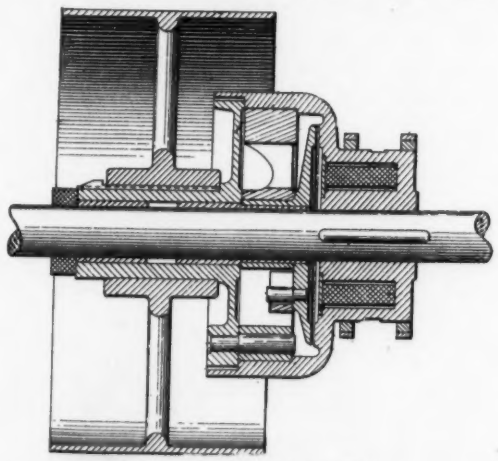
817,396. RECEPTACLE FOR INCANDESCENT ELECTRIC LAMPS; Albert P. Seymour, Syracuse, N. Y. App. filed Jan. 30, 1905. A two-part porcelain socket having grooves to receive the circuit wires and having pointed pins which penetrate the insulation and establish the connection.

817,399. PROCESS OF MAGNETIC SEPARATION; Frederick T. Snyder, Oak Park, Ill. App. filed Dec. 20, 1902. A magnetic separator in which the table has two movements, one when the magnetic field is active, and another when it is not active, so that both the magnetic and the non-magnetic ore particles have a net movement in separate direction.

817,419. PROCESS FOR THE ELECTROLYTIC MANUFACTURE OF METAL TUBES; Otto Dieffenbach, Darmstadt, Germany. App. filed Jan. 9, 1906. The process of producing galvanic deposits, which consists in mixing comminuted kieselguhr with a suitable electrolyte, passing an electric current through the mixture and simultaneously producing a relative movement between the electrolyte and the cathode to dislodge the hydrogen bubbles and to smooth the metallic deposit by the action of the kieselguhr.

817,449. RECEPTACLE FOR INCANDESCENT ELECTRIC LAMPS; Albert P. Seymour, Syracuse, N. Y. App. filed March 15, 1905. Details of a porcelain socket having a threaded shell and a central stud secured in place by screw connections.

817,457. HEAD BAND OR SUPPORT FOR TELEPONE-RECEIVERS; Kelley M. Turner, New York, N. Y. App. filed Jan. 18, 1906. A supporting band or holder for telephone-receivers comprising a pair of curved spring-sections pivoted together at their upper ends, and



817,210.—Magnetic Friction Clutch.

a ring or fork adapted to receive and hold a telephone-receiver and arranged to fold into the plane of said spring-sections.

817,463. RAILROAD SIGNAL SYSTEM; Rollin A. Baldwin and George D. Foote, New Haven, Conn. App. filed Aug. 10, 1905. A recording signal transmitter adapted to register the entrance of cars into a single track block section from either end, and to give a semaphore indication of the fact from the opposite end. The device also records the number of cars which enter the section so that a clear signal is not given until they have all left the same.

817,483. ELECTRIC FUSE IGNITING APPARATUS; James W. Howard, Connellsville, Pa. App. filed May 23, 1905. Details of an appliance containing a spark coil in a box and a push button to complete the circuit thereof when it is desired to ignite the blast.

817,484. INSULATING SCREW SHELL; Harvey Hubbell, Bridgeport, Conn. App. filed June 28, 1905. An adapter for Thomson-Houston and Edison incandescent lamps.

817,485. CHAIN GUIDE FOR PULL SOCKETS; Harvey Hubbell, Bridgeport, Conn. App. filed July 14, 1905. The socket has a laterally projecting tube which serves to guide a beaded chain which makes a partial turn around the switch element so as to rotate the same when the chain is pulled.

817,497. SIGNAL SYSTEM; Joseph H. Lynch, Red Bank, N. J. App. filed Oct. 25, 1905. The locomotive has a depending finger or tappet which is engaged by a projection on the track so as to establish certain alarm circuits within the locomotive cab.

817,498. STORAGE BATTERY; James R. Macmillan, Menomonie, Wis. App. filed Apr. 1, 1905. In a storage-battery grid unit, the combination of an inclosing frame, a plurality of horizontal ribs extending across said frame, a plurality of transverse ribs extending across said frame and intersecting said horizontal ribs to form compartments for lodgement of active material, projections on said transverse ribs extending into said compartments, said ribs and projections being quadrilateral, the top and lower edges thereof being disposed in a common vertical plane, and a web on said ribs and projections, disposed in said vertical plane, substantially as described and for the purpose set forth.

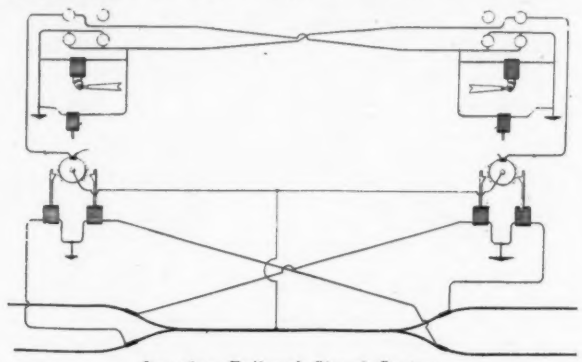
817,588. WIRE CLAMP; John A. Reising, Aurora, Ill. App. filed Apr. 13, 1905. A hollow sleeve has threaded oppositely coned ends which are longitudinally slotted or split so as to be deflected inward and clamp the circuit wires when nuts are screwed thereon.

817,593. ELECTRIC WATER HEATER; Frederic F. Shipp, St. Louis, Mo. App. filed Aug. 10, 1903. A water heater having a resistance coil embedded in an insulating cylinder and contained in a water jacket through which the fluid passes.

817,594. ELECTRICAL WATER HEATER; Frederic F. Shipp, St. Louis, Mo. App. filed Sept. 16, 1904. A number of sections of porcelain are organized together by wrapping the resistance wire thereabouts so as to form a complete resistance element.

817,597. APPARATUS FOR COMMUTING ELECTRIC CURRENTS PASSING THROUGH LAMPS, ETC.; Campbell Smart, Swansea, England. App. filed Sept. 19, 1905. The switch arm is mounted on a rod which is capable of longitudinal and rotary movements. Magnets are provided to give the longitudinal movements and a series of cam surfaces are effective to impart the necessary rotation.

817,606. ELECTRIC BRAKE; George R. Yancey, Louisville, Ky. App.



817,463.—Railroad Signal System.

filed Aug. 7, 1905. A chain or rod is connected to extend throughout the entire train and may be tightened to apply the brakes on all the cars by a motor driven drum on the forward car of the train.

817,642. INCANDESCENT LAMP CLUSTER; Harvey Hubbell, Bridgeport, Conn. App. filed Sept. 1, 1905. The usual threads of the sockets are formed directly in the porcelain and a pair of plates are organized therein so as to make the necessary electric circuits.

817,664. CONTACT DEVICE; Andrew Plecher, Los Angeles, Cal. App. filed Dec. 27, 1904. A detector for wireless telegraphy employing a plate floating against a contact in a highly rarified atmosphere. The position of the plate is adjusted by a magnet.

817,687. MAGNETIC ACTUATOR; Daniel Bacon, Brooklyn, N. Y. App. filed Aug. 24, 1904. A magnetic clutch in which the driving and the driven member have a multitude of electromagnets which when energized transmit the torque by means of their magnetic field.

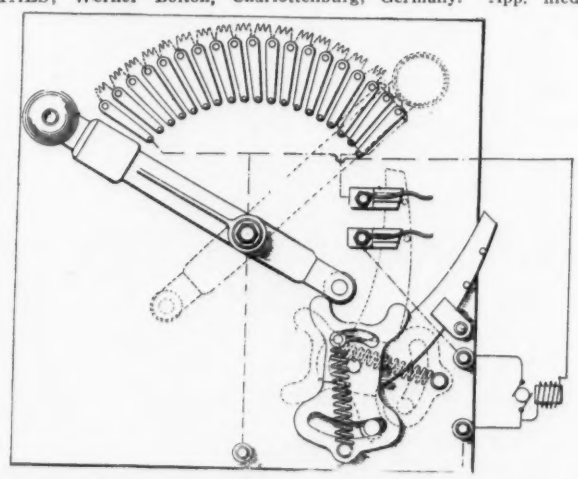
817,719. ELECTRICAL CIRCUIT CONTROLLER; Harry W. Leonard, Bronxville, N. Y. App. filed Nov. 30, 1901. A complete motor starter or rheostat having the usual swinging arm, but having various locks and features for preventing improper movements of the arm.

817,720. AUTOMATIC ELECTRIC CIRCUIT CONTROLLER; Harry W. Leonard, Bronxville, N. Y. App. filed Jan. 26, 1903. A combined no-voltage and excess current circuit breaker having a detent which moves by failure of current in either the shunt or the series magnets.

817,730. ELECTRICAL FRICTION CLUTCH; Harry A. Williams, Akron, O. App. filed Oct. 22, 1904. A multiple disc clutch in which the necessary pressure is supplied through a magnet.

817,732. ELECTRIC INCANDESCENT LAMP; Werner von Bolton, Charlottenburg, Germany. App. filed May 31, 1902. An incandescent body for electric glow-lamps, consisting of substantially pure metallic tantalum.

817,733. HOMOGENEOUS BODY OF HIGHLY REFRACTORY METALS; Werner Bolton, Charlottenburg, Germany. App. filed Jan.



817,719.—Electrical Circuit Controller.

5, 1904. A metal derived from tatalum compounds and possessing the quality of being homogeneous and ductile.

817,734. INCANDESCING BODY FOR LIGHTING PURPOSES; Werner von Bolton, Charlottenburg, Germany. App. filed May 31, 1902. A homogeneous metallic glower for incandescent lights containing ductile metal of the vanadium group, the light-emitting properties of the glower being due to the presence of this metal.

817,736. APPARATUS FOR DETECTING AND LOCALIZING MINERAL DEPOSITS; Leo Daft, Ealing, and Alfred Williams, Wimbledon, England. App. filed Oct. 14, 1902. A complete apparatus by which a fall of potential is secured through the ground in the region of a mineral deposit and an investigating circuit is provided to study the nature of the fall of potential, and thereby locate the mineral deposit.